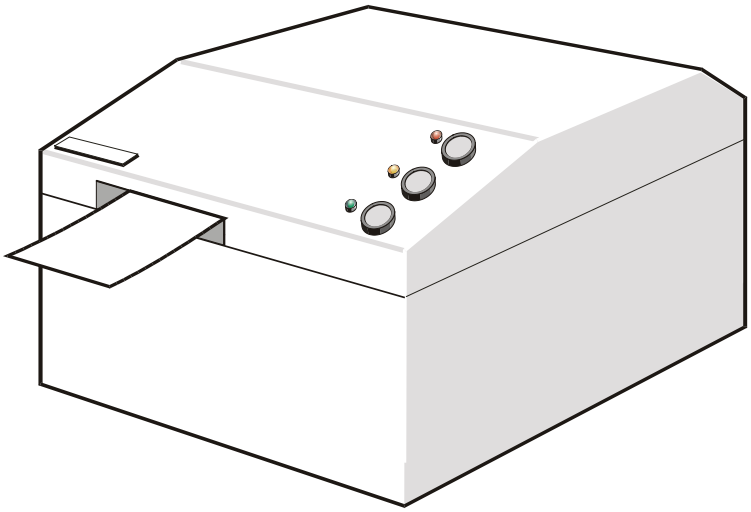


Zebra® TTPM2™

Kiosk Ticket Printer/Encoder

Installation and Programming Manual

P1003645-001

© 2009 ZIH Corp. The copyrights in this manual and the software and/or firmware in the printer described therein are owned by ZIH Corp. Unauthorized reproduction of this manual or the software and/or firmware in the printer may result in imprisonment of up to one year and fines of up to $10,000 (17 U.S.C.506). Copyright violators may be subject to civil liability.

This product may contain ZPL®, ZPL II®, and ZebraLink™ programs; Element Energy Equalizer® Circuit; E3®; and Monotype Imaging fonts. Software © ZIH Corp. All rights reserved worldwide.

ZebraLink and all product names and numbers are trademarks, and Zebra, the Zebra logo, ZPL, ZPL II, Element Energy Equalizer Circuit, and E3 Circuit are registered trademarks of ZIH Corp. All rights reserved worldwide.

All other brand names, product names, or trademarks belong to their respective holders. For additional trademark information, please see "Trademarks" on the product CD.

Proprietary Statement This manual contains proprietary information of Zebra Technologies Corporation and its subsidiaries ("Zebra Technologies"). It is intended solely for the information and use of parties operating and maintaining the equipment described herein. Such proprietary information may not be used, reproduced, or disclosed to any other parties for any other purpose without the express, written permission of Zebra Technologies.

Product Improvements Continuous improvement of products is a policy of Zebra Technologies. All specifications and designs are subject to change without notice.

Liability Disclaimer Zebra Technologies takes steps to ensure that its published Engineering specifications and manuals are correct; however, errors do occur. Zebra Technologies reserves the right to correct any such errors and disclaims liability resulting therefrom.

Limitation of Liability In no event shall Zebra Technologies or anyone else involved in the creation, production, or delivery of the accompanying product (including hardware and software) be liable for any damages whatsoever (including, without limitation, consequential damages including loss of business profits, business interruption, or loss of business information) arising out of the use of, the results of use of, or inability to use such product, even if Zebra Technologies has been advised of the possibility of such damages. Some jurisdictions do not allow the exclusion or limitation of incidental or consequential damages, so the above limitation or exclusion may not apply to you.

Contents

1 • Introduction 7

Document Printing 7
Magnetic Encoding 7
Track Combinations 7
Document Handling 8

2 • Installation 9

Installing a Desktop Printer 10
Installing an OEM Printer Mechanism 11
Installing Accessories 14
Output tray 14
Fanfold Ticket Paper Entry Tray 15
Card Dispenser 16

3 • Operation 17

Operator Controls 17
General Reset 17
Paper Loading 18
Paper Stock Positioning 18
Loading Through Rear Document Entries 19
Loading Through Front Document Entry (Optional) 19
Loading Sheet-cut Tickets In Optional Card Dispenser 20
Paper Jam Removal 21
Tickets Stuck In Input Module 21
Tickets Stuck In Output Module 21
Exit Paper Jam Clearing Mode 21

Self Test Mode/Ticket Repeat Mode 22
Self Test 22
Repeat Fixed Print 22

4 • Command Set 23

Syntax 24
Printing and Encoding Capability Overview 25
Text 25
Graphics 25
Bar Codes 26
Magnetic Codes 26
Positioning Data on the Ticket 26
Triggering a Printout 27
Command Acknowledgment 27
Summary of Commands 30
System Commands 30
Document Entry Commands 31
Print-Parameter Commands 31
Magnetic Encoding/Decoding Commands 32

5 • Command Reference 33

System Related Commands 33
Document-Entry Related Commands 40
Print Related Commands 43
Introduction 43
Text Printing 43
Graphics Printing 45
Printing Bar Codes 47
Canceling a Ticket 49
Magnetic Encoding- and Decoding-Related Commands 51
Encoding 51
Checksum 52
Reading and Decoding 53
Magnetic Encoding Attributes 53
Magnetic Encoding Retries 54
Encoding Examples 54
What Can You Encode? 55
Track 1 ISO Encoding 55
Track 2&3 ISO Encoding 58

6 • TTPM2 Start-Up 59

Power Failure Cleanup 59
Start-Up Synchronization 59

7 • Document Examples 61
Text Attributes 68
Printing Bold Text 68
Reversed Text 69
8 • Single-Ticket Handling 71
Overview 71
Previously Encoded Tickets 72
Inserting a Single Ticket 72
Read and Decode 73
Encode and Print 73
Ejecting the Ticket 74
9 • Error Handling 75
Power Up 75
Normal Operation 75
10 • Error Codes and Status Reporting 77
Status 77
Security Additions 78
Errors 79
11 • Interface Description 81
DIP Switches 81
Communications Protocol 82
Communications Port 82
Communications Cable 82
12 • Document Stock 83
Ticket Base Material 84
Coating and Preprint 85
Thermal-Print to Preprint Alignment 85
Magnetic Media 85
Ticket Dimensions and Perforation 86
Tickets With 45° Cut Corners 89
13 • Firmware History 91
Index 95

1 Introduction

This document describes installation and operation of TTPM2 Ticket Printer/Encoder, which creates credit-card-wide documents with magnetic encoding and thermal printing.

Document Printing

TTPM2 uses the direct thermal printing technique and can print the entire thermo sensitive surface of the document with text or graphics, or both. Text block position and orientation is software programmable as is the character size.

A text block can be identified as either *fixed information* which is stored in the unit until an ”All Clear” software command is sent, or as *variable information*, automatically erased as soon as printing of the document has been completed. This feature allows printing from a data file containing the variable data information.

EAN-13, Code 39, and Code 2-of-5 interleaved bar-codes can be generated and printed.

Magnetic Encoding

Two magnetic tracks can be encoded: Either with standard low coercivity recording, or optional “household-magnet proof” high coercivity recording.

Track Combinations

- ISO track 2 at 75 BPI (Bits Per Inch), and ISO track 3 at 210 BPI
- ISO track 1 at 210 BPI, and ISO track 2 at 75 BPI
- Center track at 75 or 210 BPI

Naturally, the TTPM2 can be used for encoding on a single track only.

Encoding in ISO standard format, or in hexadecimal format, is software selectable. Read-after-write is automatically performed. Software selectable decode functions are available.

Document Handling

A standard TTPM2 printer has one document entry for fanfold ticket stock, and one entry for handfed tickets. The printer can be ordered in Dual Consecutive enTry (DCT) version with both upper and lower entries designed for fanfold ticket stock.

There are three optional front load alternatives designated FL1, FL2, and FL3. FL1 and FL2 make it possible to load single tickets through the ticket exit, which replaces the upper single ticket entry at the rear of the printer. In addition to this, FL2 and FL3 have a wastebasket function for redirecting used or invalid tickets to a wastebasket, thus preventing useless tickets being presented to the customer.

FL3 makes it possible to fully eject the ticket so that it falls into a tray where the customer picks it up, or to a wastebasket as described above.

An external card dispenser that can be added to the printer handles sheet cut tickets and cards. The card dispenser can hold a 95mm ticket pile (200 to 400 tickets depending on ticket thickness).

2

Installation

The TTPM2 comes as desktop printer with a cover and a built-in power supply and, or as an OEM printer mechanism for kiosk applications.

Figure 1 • Front view, desktop printer, and OEM printer mechanism

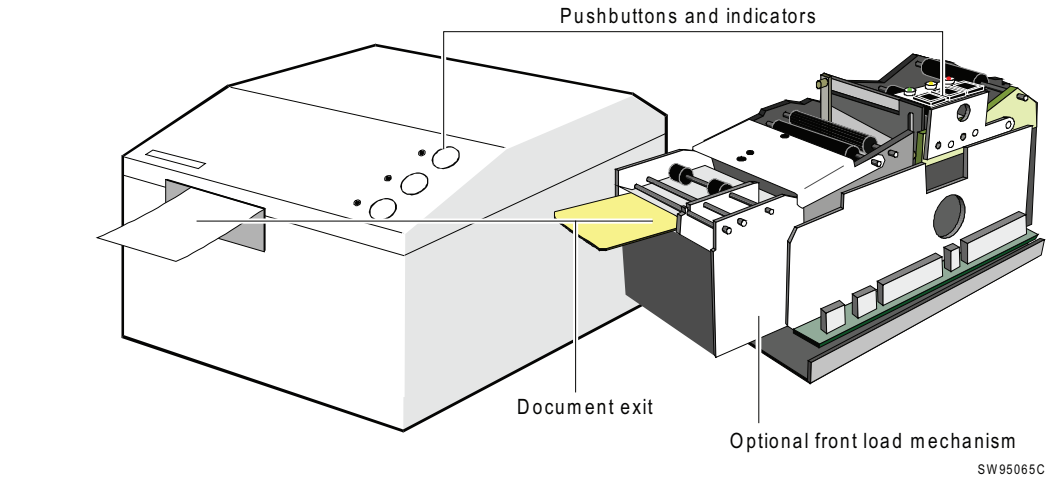
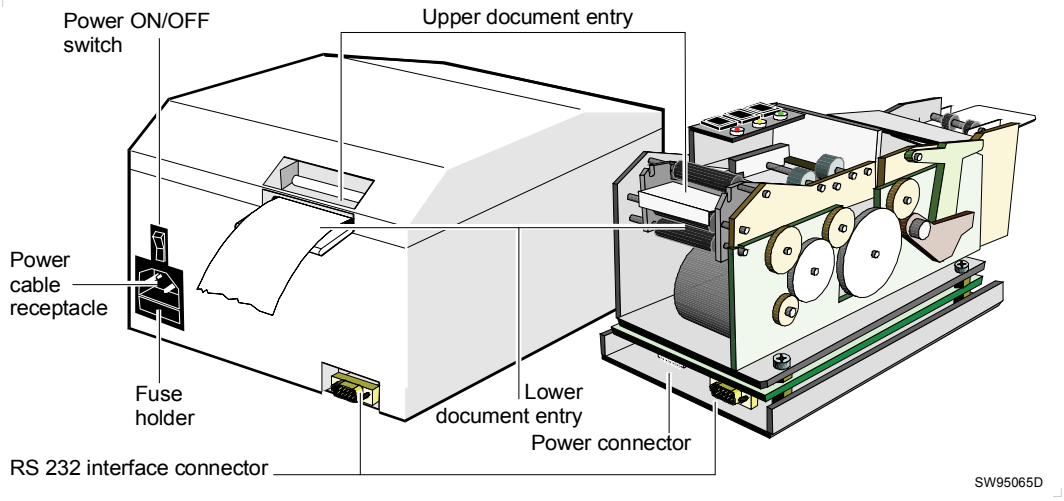


Figure 2 • Rear view, desktop printer, and OEM printer mechanism



Installing a Desktop Printer

1. Verify that the supply voltage range stated on the type plate is suitable for your local line voltage.
2. Connect the printer to a line outlet with safety ground.

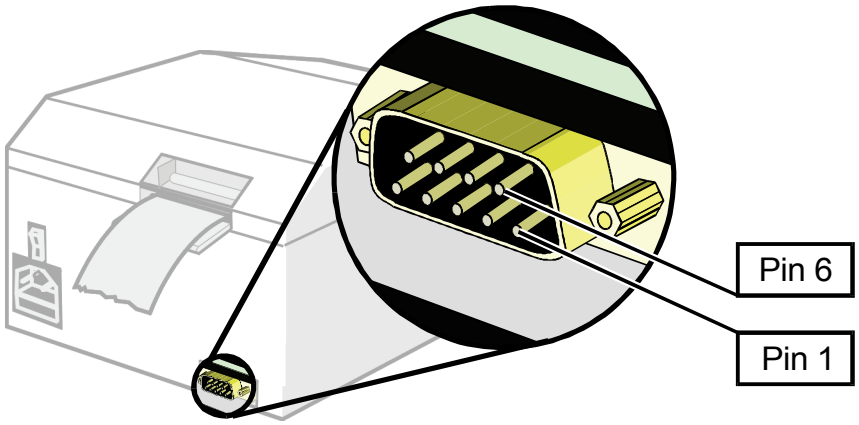
   The ground potential should be the same as for the host computer. If ground potentials differ, use a short distance modem between the computer and the printer.
3. Clear the memory of the printer by making a general reset (hold down all three buttons while turning ON the printer, then turning it OFF again).
4. Turn on the printer.

   The green indicator should light up.
5. Press the front button.

   The green indicator starts flashing and the yellow indicator lights up, indicating ”Out of Paper”.
6. Turn the tickets so that the magnetic stripe is on the left side facing downwards, as seen from the front of the printer.
7. Insert tickets in the lower document entry. The printer feeds the tickets forward and cuts and ejects one ticket.
8. Turn off the host computer and the printer.
9. Connect a serial cable between the COM port of the host computer and the serial input of the TTPM2 printer.

   The printer is ready for use.

Figure 3 • RS232 serial interface connector pin assignment



SW97101C

Installing an OEM Printer Mechanism

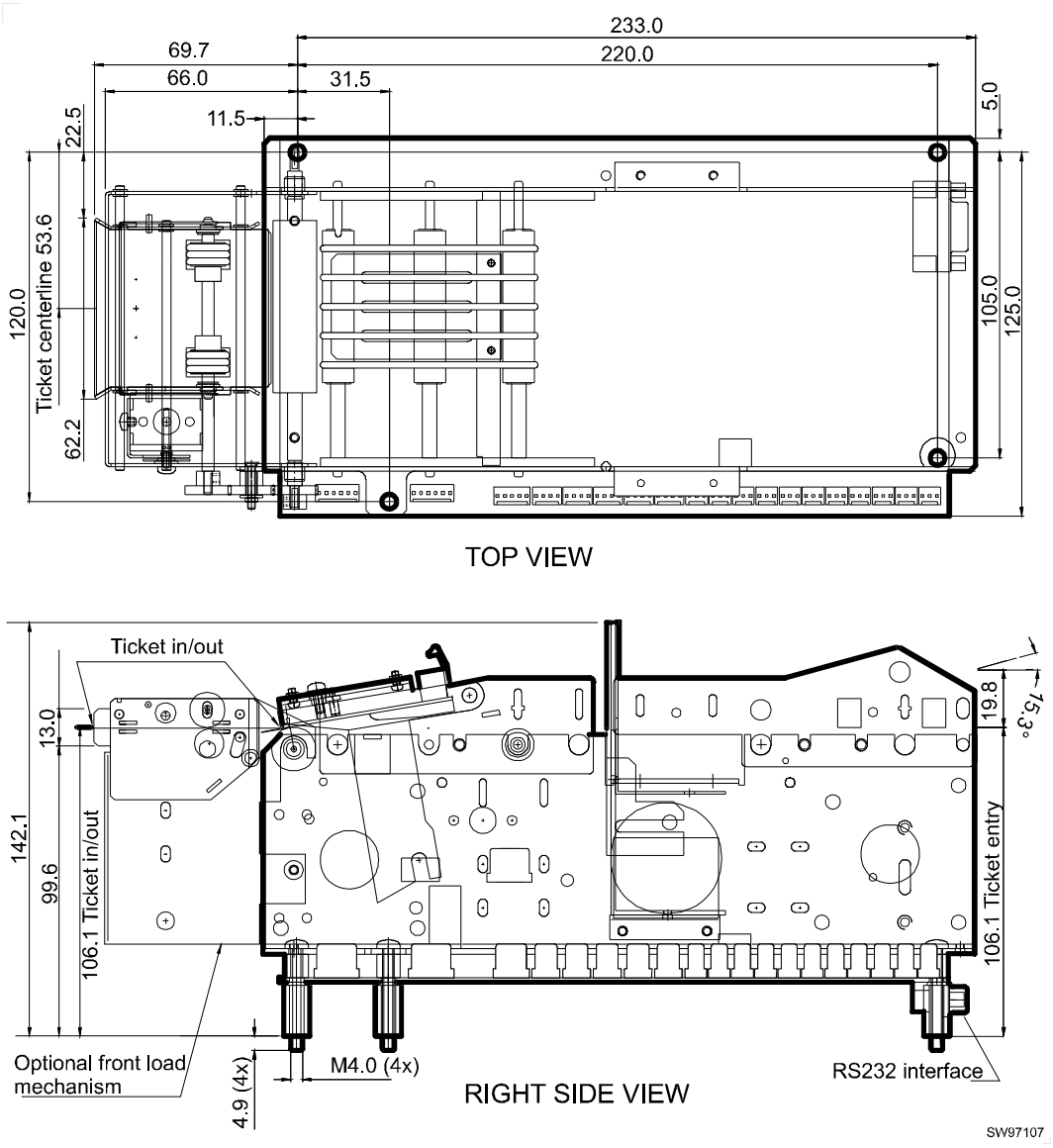
The TTPM2 OEM printer mechanism should be installed in some kind of enclosure such as a self-service kiosk.

Preventing ESD and earth currents from affecting the printer operation requires proper connection of the printer chassis to protective earth through a mounting platform or through a separate earth conductor.

Trouble free printer operation also requires the printer's optical sensors to be shielded from ambient light.

Additional space is required for paper stocking and paper jam. Consider mounting the printer on a movable platform so that the printer can be maintained outside the printer enclosure.

Figure 4 • Dimension drawing for printer mechanism. All measurements are in mm

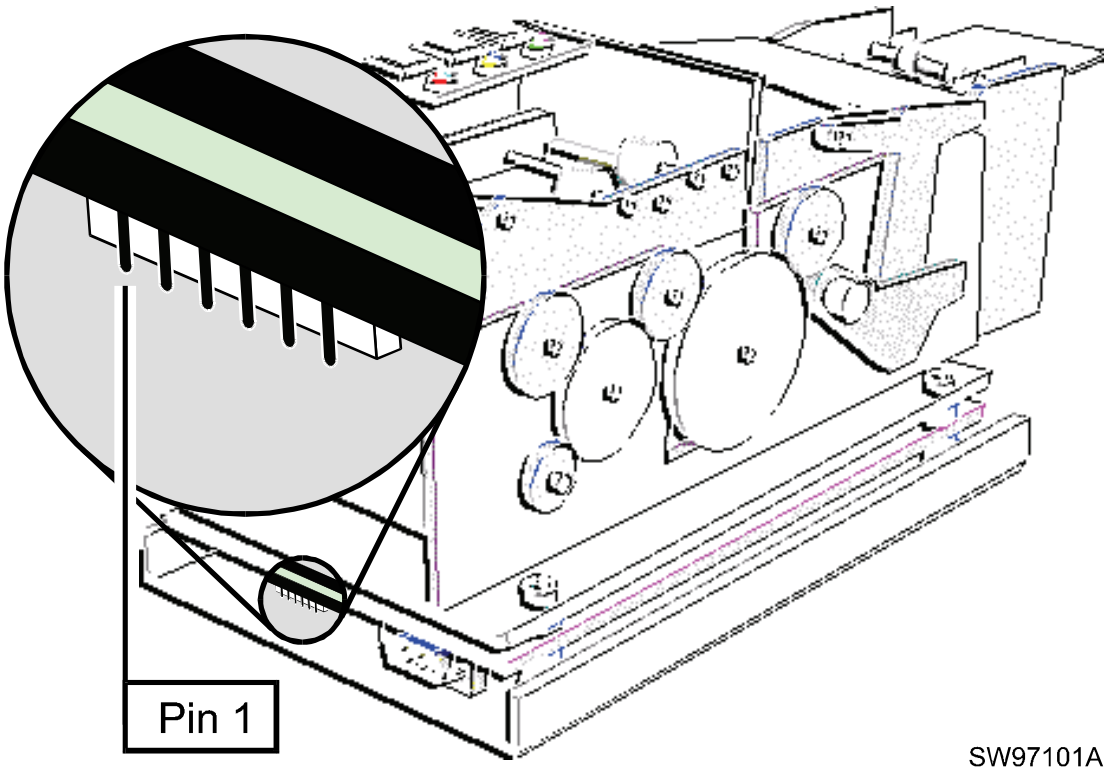


The printer mechanism requires +5 Vdc, 0.3 A, and + 24 Vdc 2 A continuous, 6 A peak. This is fed to the printer through J5 on the control board.

With Zebra power supplies, just connect the cable from the power supply to J5.

If you use another type of power supply, connect the voltages according to the following table. At the TTPM2 end of the cable, use a Molex 22-01-2065 connector housing and six Molex 08-50-0032 contact springs. The cable area should be 6 x 0.24mm^2, and the cable length no more than 0.5 m. If longer cable is required, a 5 V regulator has to be placed near the printer. The 24 V should feed this regulator.

Figure 5 • Power supply connector pin assignment



Note • Both the 5 V and 24 V ground, as well as the chassis of the printer, must be connected to ground potential (safety ground).

Caution • If you do not use a non Zebra Power supply, the one you use must have the correct timing; 5 V must be on and stable in advance of 24 V at power on, and remain on until after 24 V disappears at power off.

After fastening the printer, proceed with *Introduction* *on page 7*.

Installing Accessories

Output tray

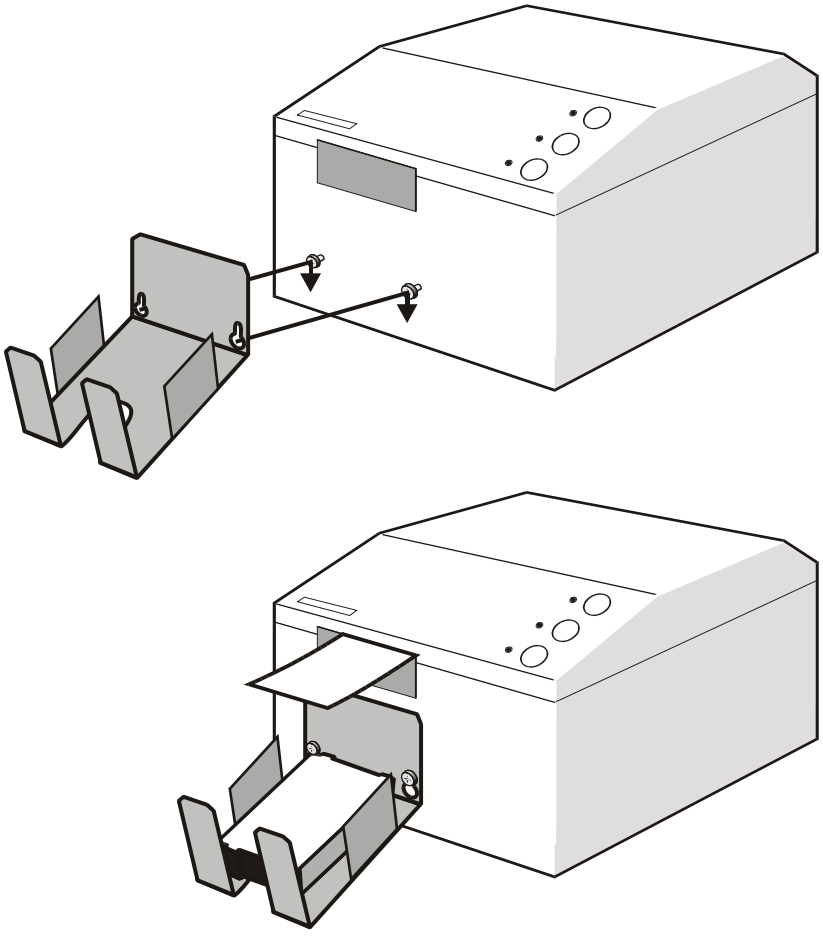
The output tray collects the printed and coded tickets in a neat stack. Use the tray if you intend to print many tickets at a time.

1. Loosen the two screws at the front of the TTPM2 case.

Important • *Never* loosen more than 5 turns or the nut plate will fall down inside the printer!

2. Hook the tray on to the two screws.
3. Tighten the screws.

Figure 6 • Installing the output tray



SW97105 R1

Fanfold Ticket Paper Entry Tray

This optional entry tray holds ticket paper for one- or two- document-entry applications. The capacity is between 125 and 300 tickets for each entry (depending on ticket stock thickness).

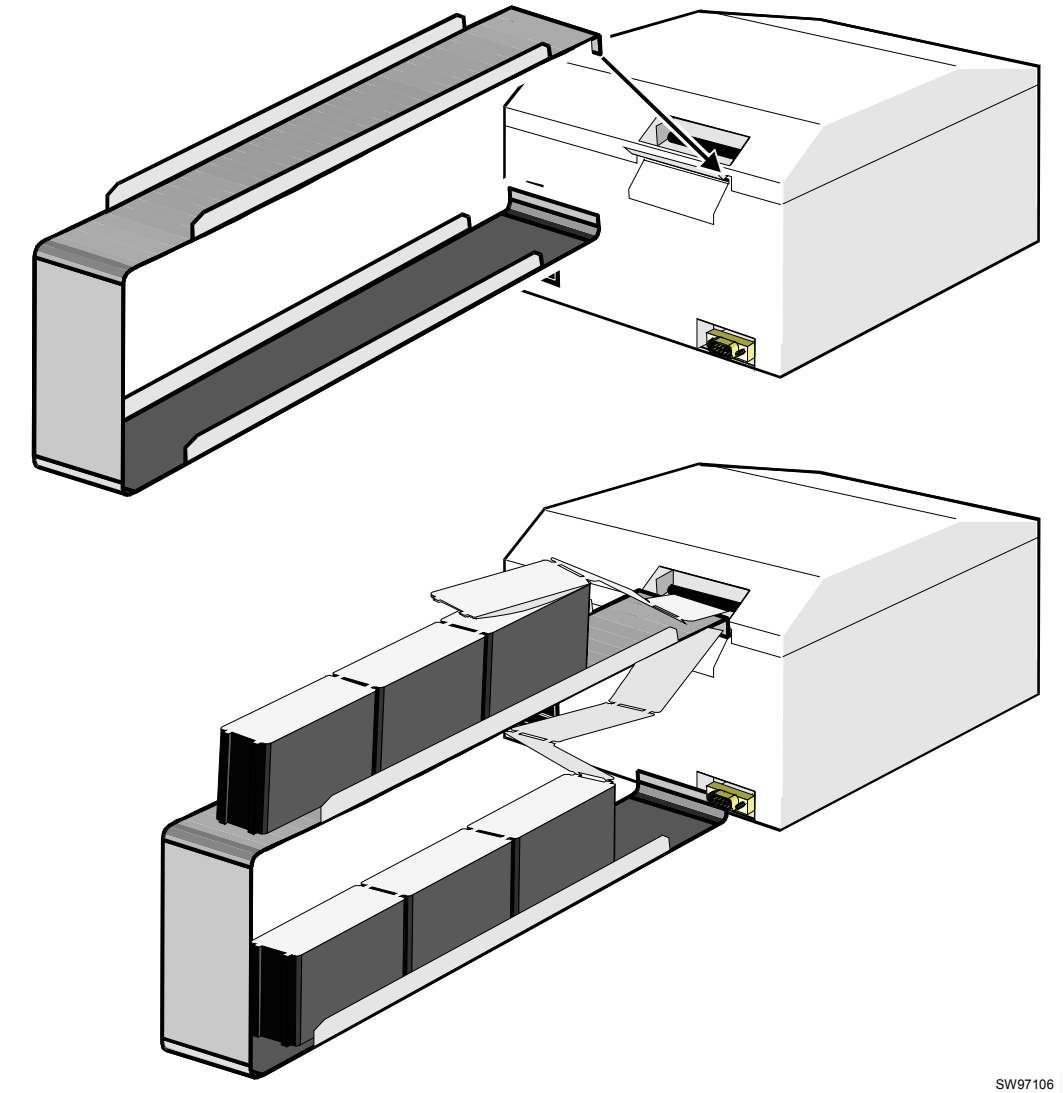
1. Position the entry tray on the table behind the printer.

   Make sure the tray engages properly with the hook above the lower document entry.

2. Put the pile of fanfold paper on the tray and load the paper into the printer.

   Never add more than a 5-cm pile at a time. Otherwise the paper will not feed correctly.

Figure 7 • Installing the optional entry tray

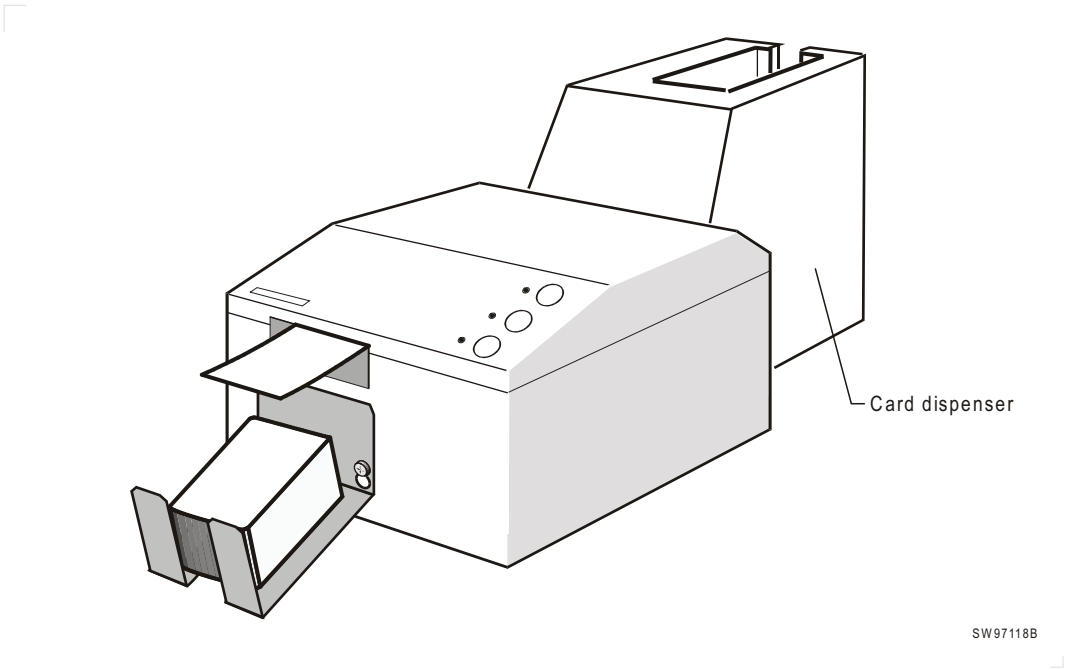


Card Dispenser

The TTPM2 model with card dispenser is fully assembled by Zebra. Both the TTPM2 and the card dispenser are mounted on a common base plate (not shown). The dispenser is connected to the TTPM2 control board and the serial interface is moved to the back of the card dispenser by means of an extension cable.

Example • Follow the procedure *Introduction* *on page 7*, and *Introduction* *on page 7*.

Figure 8 • A desktop TTPM2 printer equipped with card dispenser. The OEM printer mechanism can also be equipped with card dispenser.

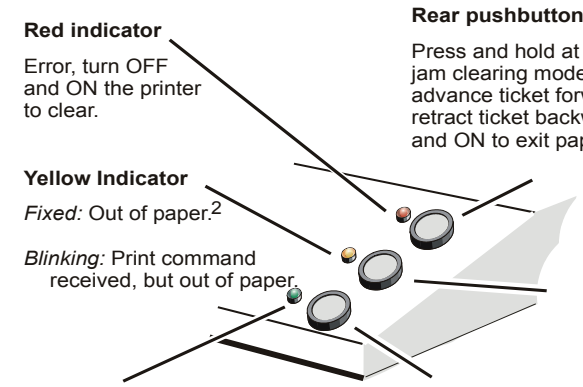


3

Operation

Operator Controls

Figure 9 • Indicators and pushbuttons



Red indicator

Error, turn OFF and ON the printer to clear.

Yellow Indicator

Fixed: Out of paper.[2]

Blinking: Print command received, but out of paper.

Green indicator

Fixed: Power ON & printer ready.

Blinking: Insert ticket.

Flickering: Receiving data.

Temporarily OFF: Commands are executed.

Rear pushbutton

Press and hold at power ON to turn on paper jam clearing mode. Press front button to advance ticket forward and middle button to retract ticket backwards. Turn printer OFF and ON to exit paper jam clearing mode.

Center pushbutton

1. Ejects any document in the selected ticket track. (Same as when an !E command is received.)
2. Press and hold at power ON to run cleaning card through printer.

Front pushbutton

1. Cuts and ejects a ticket[1].
2. Press and hold at power ON to enter self test mode. Press again to encode and print one ticket. The printout shows current firmware version. Turn printer OFF and ON to exit self test mode.

SW97108

General Reset

A general reset of the TTPM2, restoring all parameters to their default value, is effectuated if all three pushbuttons are kept depressed at power ON. All three indicators will light but nothing else will happen. At this point, the power has to be turned OFF and ON once more. The TTPM2 is then reset.

Paper Loading

The yellow indicator indicates paper out.

Press the center button to eject remaining tickets if you want to replace paper stock before paper is out.

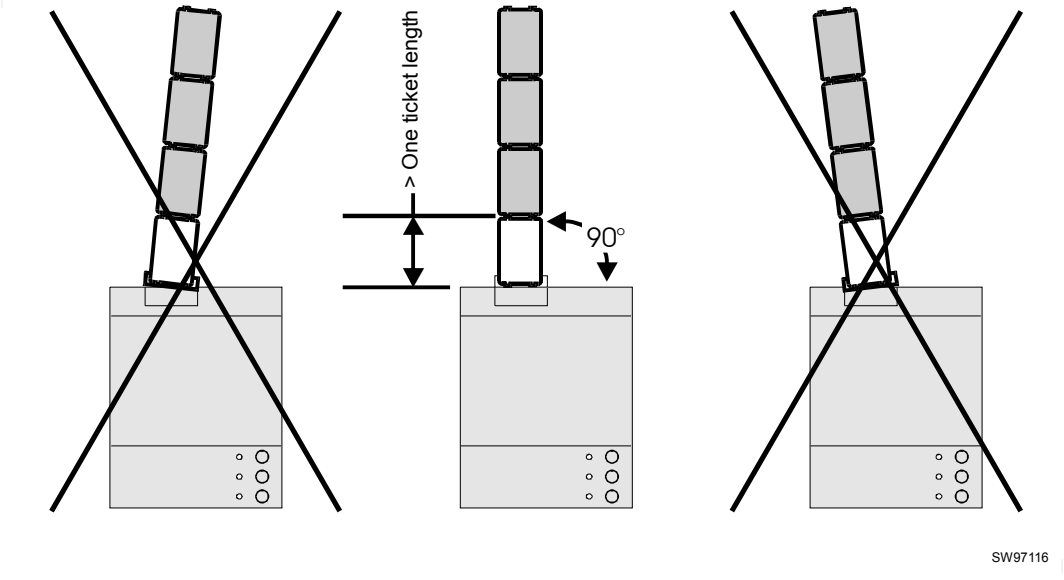
Note • Do not hold the front button depressed! Doing so will result in erroneously cut tickets often resulting in paper jam.

Note • On CD 200 versions, load new ticket stock, **then** press the center pushbutton.

Paper Stock Positioning

The ticket stock should be oriented with the magnetic stripe down to the left as seen from the front of the TTPM2. The pile of fanfold tickets should be placed at a distance of at least one ticket length behind the printer.

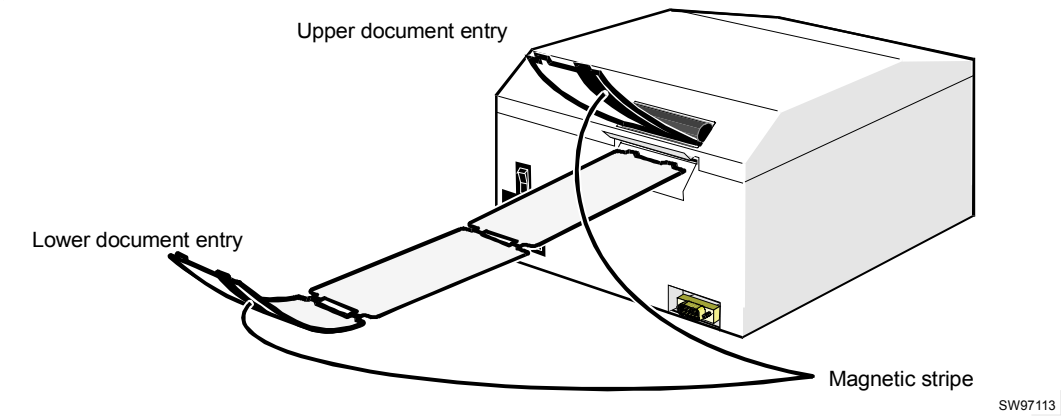
Figure 10 • Positioning the ticket stock



Loading Through Rear Document Entries

Insert the ticket stock into the desired document entry. When the input sensor detects the ticket it will be pulled into the active position. Fanfold ticket stock is usually loaded in the lower document entry, and single tickets in the upper document entry. On printers with two fanfold entries, you may also use fanfold tickets in the upper document entry.

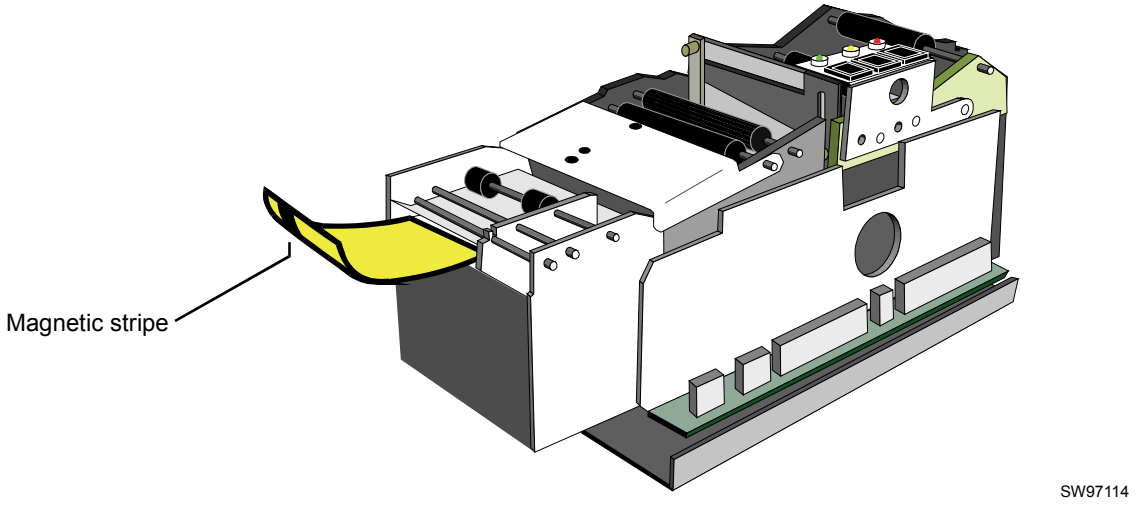
Figure 11 • Position of the magnetic stripe when loading paper



Loading Through Front Document Entry (Optional)

Insert a single ticket into the document entry with the magnetic stripe facing down to the left, as seen from the front of the printer. When an !L3 command has been received and the input sensor detects the ticket, this will be pulled into the active position of the upper rear document entry.

Figure 12 • Position of the magnetic stripe at front load

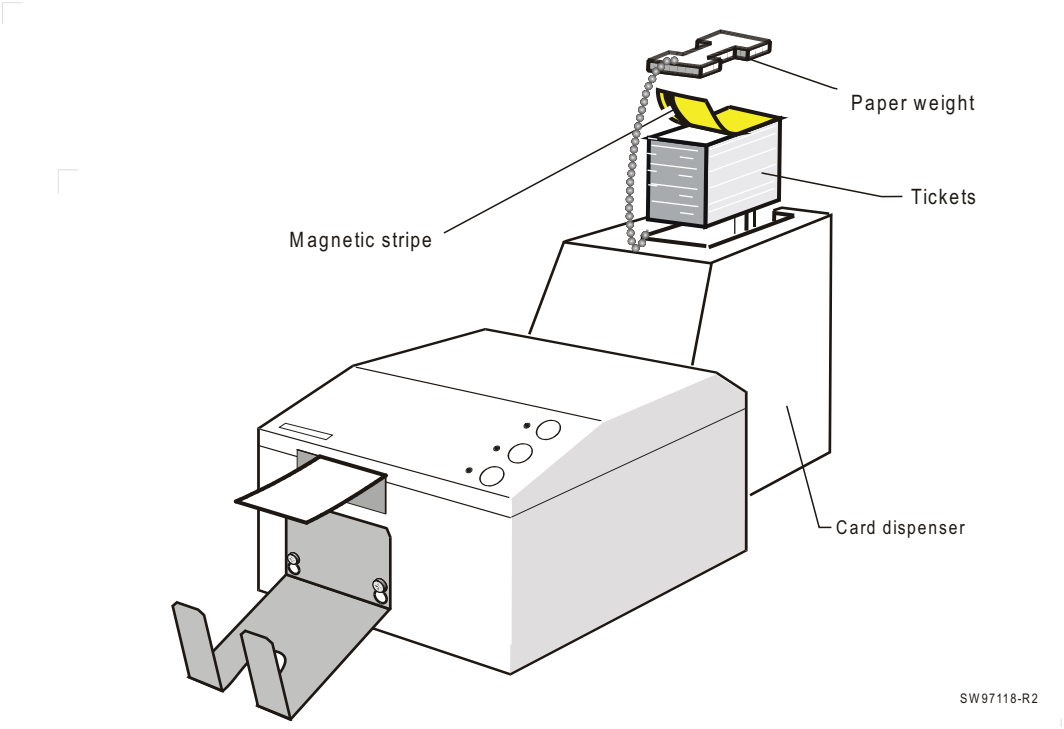


Loading Sheet-cut Tickets In Optional Card Dispenser

The card dispenser is factory adjusted to a specific card thickness, usually 0.18 mm to 0.25 mm as indicated on a label on the dispenser. Using thicker or thinner tickets will cause paper jam.

The ticket stock should be oriented with the magnetic stripe down to the left as seen from the front of the TTPM2. Put the paperweight on top of the ticket pile, then press the center push button to load a ticket and the printer is ready.

Figure 13 • Loading tickets in the card dispenser.



Paper Jam Removal

Open the TTPM2 cover to locate and remove the ticket that is stuck in the mechanism. Use the following procedure:

1. Select paper jam clearing mode
2. Power OFF.
3. Push and hold the rear pushbutton while turning ON the power.
   The red indicator shows a steady light to indicate paper jam clearing mode.

Tickets Stuck In Input Module

Press and hold the center push button to eject the ticket towards the rear of the unit.

Tickets Stuck In Output Module

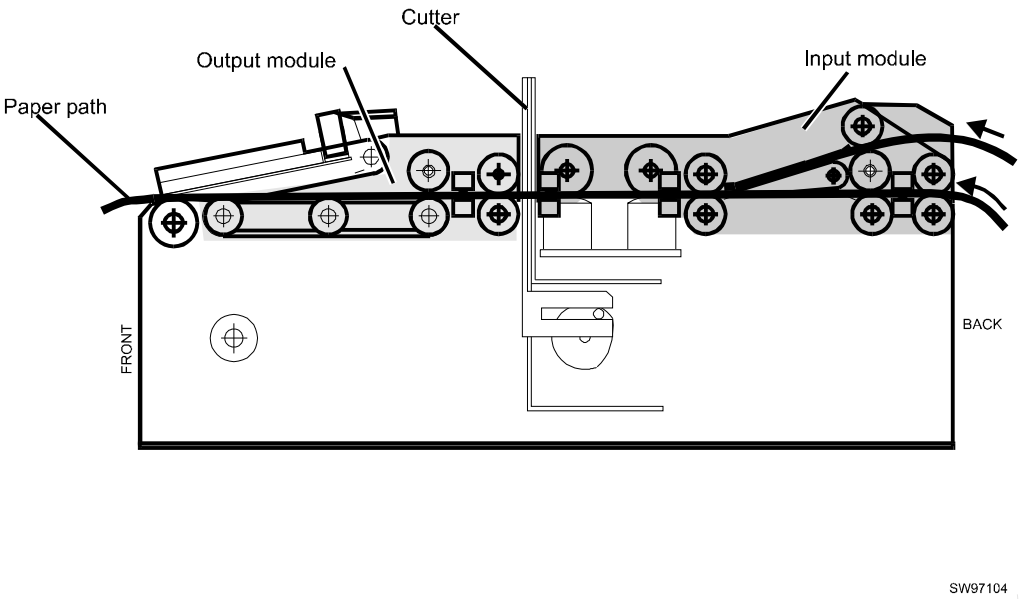
Press and hold the front push button to eject the ticket towards the front of the unit.

Exit Paper Jam Clearing Mode

Power OFF and back ON again, the TTPM2 is operational but any ticket information previously sent to the unit is lost.

You can also power OFF the printer and turn the feed rolls manually to remove the blocking ticket.

Figure 14 • Paper path.



Self Test Mode/Ticket Repeat Mode

Self Test

1. Press and hold the front pushbutton at power ON to enter self-test mode.
2. Press again to encode and print one ticket. The printout shows current firmware version.
3. Turn printer OFF and ON to exit self-test mode.

Repeat Fixed Print

1. Start self-test mode as described above.
2. Download the ticket data to the printer, and print one ticket.
   The data must only contain fixed text, fixed encoding data, and graphics.
3. Press the front button once and an exact copy of the first ticket will be printed.
   This will be repeated each time that the front button is pressed.
4. Turn printer OFF and ON to return to normal operation.

Note • Do not hold the front button depressed! Doing so will result in erroneously cut tickets often resulting in paper jam.

Note • Repeating fixed print only works on printers where the auto clear function is OFF. Auto clear is enabled/disabled with a DIP-switch on the control board.

4

Command Set

The command set is designed in accordance with industry standards and is enhanced with functions unique to this product. The command language uses only printable ASCII characters for easy adaptation to any host system.

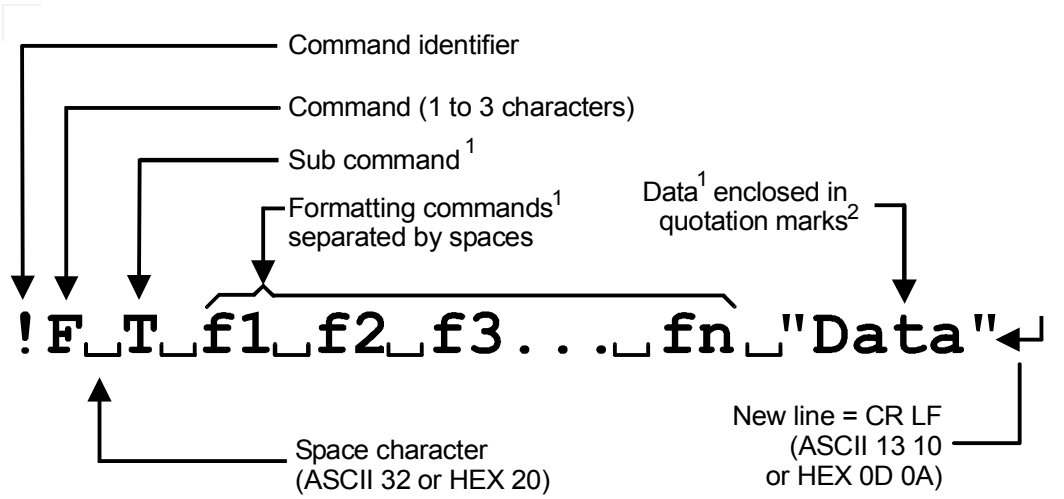
Syntax

A command string always starts with an exclamation mark (ASCII 33 or HEX 21) serving as command identifier. The exclamation mark must be at the first position of the line, that is, directly after a CR LF. Otherwise it will not be recognizes as command identifier.

The characters immediately following the "!" (21H) form the actual command to the printer. The command consists of 1–3 characters and is followed, when applicable, by a sub command, formatting commands, and data separated by space characters as shown in Figure 15.

A Carriage Return and Line Feed end each command.

Figure 15 • Command Syntax


Command identifier
Command (1 to 3 characters)
Sub command 1
Formatting commands1 separated by spaces
Data1 enclosed in quotation marks2
!F␣T␣f1␣f2␣f3...␣fn␣"Data"↵
Space character (ASCII 32 or HEX 20)
New line = CR LF (ASCII 13 10 or HEX 0D 0A)

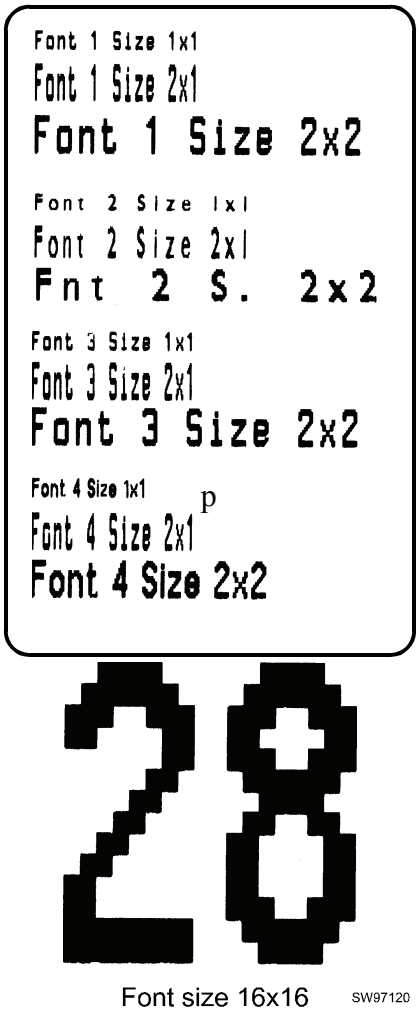
1 Only used with some commands

2 Graphical data starts directly without any quotation mark and ends after the specified number of bytes

SW97119

Printing and Encoding Capability Overview

Text



Font size 16x16 SW97120

It is possible to print text in four fonts, in four orientations, and in 16 different sizes.

Text is divided into two categories:

•Fixed text that is repeated on following tickets

•Variable text that is deleted immediately after printing

Fixed text is normally used for headers etc. as well as for establishing printing parameters for the variable information.

Variable text is used for names, seating numbers, departure times, dates, etc.

Graphics

Bitmap graphics, such as logotypes, prints in the size and orientation in which they where downloaded. Graphics print on all following tickets until a ”Clear all” command is received, so you only have to download graphics once.

Remember, when creating graphics for the TTPM2 printer, that the pixels are not square, but has a height/width ratio of 1.32:1.

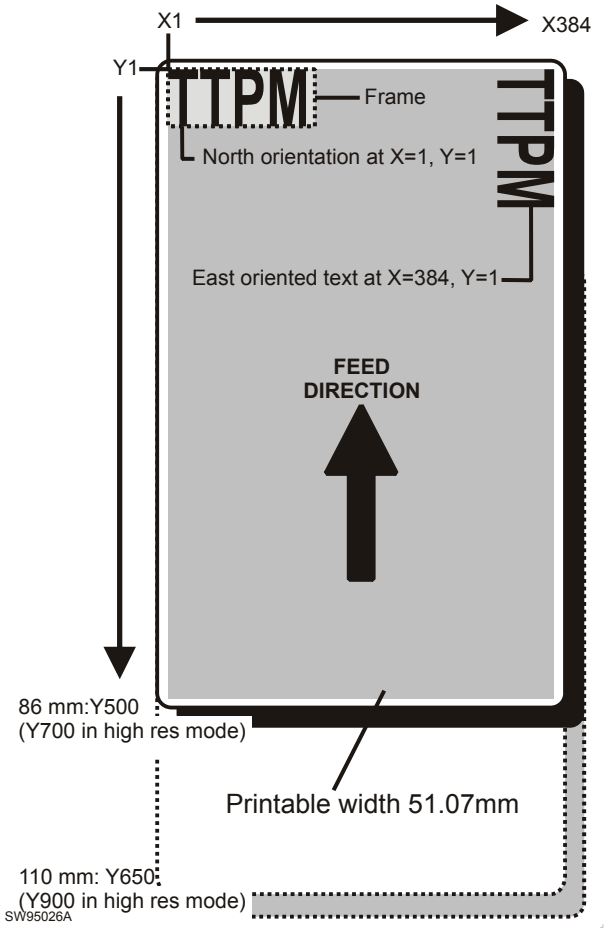
Bar Codes

Bar code data fed to the printer are converted to an EAN13, Code39, or 2-of-5 interleaved[1] bar code. The bar code prints on all subsequent tickets until a ”Clear all” command is received, or until new bar code data with the same coordinates and type is received.

Magnetic Codes

Messages can be magnetically encoded on a stripe at the back of the ticket. The message can be between 37 and 107 characters long depending on the coding standard and density you select.

Positioning Data on the Ticket



Items to be printed are placed within frames. You position the frame by defining the X and Y coordinate of the upper left corner, and the orientation of the frame. The frame is then automatically sized to the contents you put in it (character size, No. of characters, graphics size, and other data for the item to be printed).

Frames can overlap each other. You can for instance print text on top of graphics.

1. Included from firmware version 3.65.

Triggering a Printout

Putting text, graphics, bar and magnetic codes on the ticket as described above only builds an image of the ticket in the printer memory. To actually print something on a ticket, you must send a print command:

- !P↵

Every received "!P CR LF" prints one ticket. (On dual document entry printers you must also send a select document entry command, see *Document Entry Commands* *on page 31*.)

If you have variable text on your tickets, the data to be printed in the variables must precede the !P. If two variables are used for instance, a print command could look like this:

Example •

Thursday 16 October 1999 ↵

Seat 311 ↵

!P ↵

Command Acknowledgment

Ticket issuing is automatically acknowledged by the TTPM2 by sending an ACK (06h) to the host computer after a successful read-after-write of the encoded magnetic information.

If no encoding command and data are sent to the TTPM2, the ACK is still sent (read-after-write verifies that no data is encoded).

Some other commands are also acknowledged, see table below.

Note • ACK/NAK must be enabled through dipswitch settings, see *DIP Switches* *on page 81*.

Extended Acknowledgement[2]

It is possible to extend the acknowledgement procedure so that most commands are acknowledged by the printer.

To enable the function you have to the send the command:

- !CA

A ticket should therefore always start with the commands:

- !C
- !CA

The extended acknowledgement is a command number appended to the ACK. The command number is a 1 byte hexadecimal number according to the following table.

Command	Acknowledgement		When?
	Normal	Extended	
!P	06h	06h 80h 06h 02h	After a successful magnetic encoding. After printing.
!C		06h 04h	After clear memory
!F		06h 05h	After formatting data in memory
!L		06h 08h	After successful track load / eject operation
!L17	06h	06h 08h	When the lower input contains ticket stock
!L18	06h	06h 08h	When the upper input contains ticket stock
!L3	06h	06h 08h	When a ticket has successfully been loaded from the front to the upper input track.
!L4	06h	06h 08h	When successful eject through front entry
!E		06h 09h	After successful eject through rear entry
!Q		06h 14h	After transaction string is written in memory
!Z		06h 18h	After burn time is changed
!X		06h 19h	After changed resolution

2. Introduced in version 4.06.

The following is a simple example:

Sent to printer	Acknowledgement
!C	06h 04h
!CA	06h 04h
!F T E 309 014 10 03 02 1 "TEST TICKET WITH FULL"	06h 05h
!F T E 259 024 10 03 02 1 "75 BPI TRACK 2 STRING"	06h 05h
!M12345678901234567890123456789012345678901234567	06h 80h
!P	06h 02h

Additional Commands

In addition to the command that specifies the print, there are a number of other commands used for functions such as:

- Clearing of the TTPM2 buffer
- Selection of document entry
- Decoding of documents
- Generation of status requests

All applicable commands are listed in the following pages. Detailed descriptions of the software commands are given with syntax explanations as well as commented examples.

Ticket Memory

The TTPM2 printer has 128k of nonvolatile RAM (lithium battery backup, with approximately 7 years battery life). This memory stores the entire ticket so you can continue after power OFF, without having to reload the data.

The ticket printing area is 384x512 pixels for an 86 mm ticket, and 384x656 pixels for a 110mm ticket.

Note • Make sure not to print data outside this area when you use the !F command. If you do, you write in parts of the memory that are used for other functions in the printer, and the result is totally unpredictable.

Initialization After Power OFF

To initialize the printer after power ON you just send a print command (!P) and the printer is ready for use.

Note • The first !P after power ON initializes the printer. No ticket is produced.

If you want to clear the memory and start a new ticket you have to send the clear all command !C.

Summary of Commands

System Commands

!C	Clear all	page 33
!C1	Clear retract counter	page 33
!CA	Clear all and enable extended acknowledgement[a]	page 33
!F A	Feed- acceleration and speed[b]	page 38
!P	Encode and print document	page 33
!P@	Encode and print document, and eject it in wastebasket (FL2 and FL3 printers)	
!PE	Encode and print document, and eject it to tray (for FL3 printers)[c]	
!PS	Print slow[d]	
!PM	Print medium[d]	
!PF	Print fast[d]	
!U	Firmware version query[e]	
!S	Status request	page 35
ENQ	Status request immediate	page 38
CAN	General reset, equivalent to power OFF/ON (takes 20 s to execute)	
!Q	Writes a transaction string to RAM	page 34
!V	Reads the transaction string written by !Q[e]	page 35
!W	Reads thermal print progress indicator[e]	page 36
!X	Set resolution	page 36
!Y	Read ticket counter[f]	page 36
!Y1	Read retract counter[g]	page 36
!Z	Burn time[h]	page 37

a. Introduced in firmware 01789-406
b. Introduced in firmware version 4.49d
c. Introduced in firmware xxxxx-399s, replaced by !F A in version 4.49
d. Introduced in firmware xxxxx-3.39zb
e. Introduced in firmware xxxxx-332
f. Introduced in firmware xxxxx-360
g. Introduced in firmware xxxxx-424
h. Introduced in firmware xxxxx-384

Document Entry Commands

!A	Sets ticket length for roll ticket without blackmarks[a]	page 40
!E	Ejects document through the upper rear document entry (for example after decoding)	page 40
!L1	Selects lower rear document entry, and waits if paper is out (for units with dual consecutive entries[b])	page 40
!L2	Selects upper rear document entry, and waits if paper is out (for units with dual consecutive entries)	page 40
!L3	Loads document through front entry	page 41
!L4	Ejects document through front entry	page 41
!L5	Transports document to waste bin (only for printers with front load 2 and 3)	page 41
!L17	Selects lower rear document entry and signals if paper is out (for units with dual consecutive entries[c])	page 42
!L18	Selects upper rear document entry and signals if paper is out (for units with dual consecutive entries[c])	page 42
!T	Sets timeout for retract function[d]	page 42

a. Introduced in firmware version 4.55.
b. !L1, !L2, !L17 or !L18 must be selected on units with dual document entries.
c. Both the 5 V and 24 V ground, as well as the chassis of the printer, must be connected to ground potential (safety ground).
d. Introduced in firmware version 3.75.

Print-Parameter Commands

Note • Make sure not to print data outside this area when you use the !F command. If you do, you write in parts of the memory that are used for other functions in the printer, and the result is totally unpredictable.

Note • Both the 5 V and 24 V ground, as well as the chassis of the printer, must be connected to ground potential (safety ground).

!F T	Print text	page 43
!F G	Print graphics	page 45
!F C	Print bar code	page 47
!F M	Specifies No. of retries + cancellation text to be printed if encoding fails	page 49

Magnetic Encoding/Decoding Commands

!D	Reads and decodes data in ISO format from track 2 (or center track)	page 53
!D1	Reads and decodes data in ISO format from track 1	page 53
!D3	Reads and decodes data in ISO format from track 3	page 53
!I	Defines data to be encoded in ISO format on track 3	page 51
!J	Defines data to be encoded in ISO format on track 1	page 51
!K	Defines data to be encoded in Hex format on track 1 or 3 (as applicable)	page 51
!M	Defines data to be encoded in ISO format on track 2 (or center track)	page 51
!N	Defines data to be encoded in hexadecimal format on track 2 (or center track)	page 51
!N+	Same as !N but reverses the bit order [a])	
!O1	Reads data in hexadecimal format from track 1 (or center track)	page 7
!O2	Reads data in hexadecimal format from track 2 (or center track)	page 7
!O3	Reads data in hexadecimal format from track 3 (or center track)	page 7

a. Added in firmware version xxxxx-332.

5

Command Reference

System Related Commands

!C	Clear all

This command takes no parameter. All definitions are cleared. Stored layout is erased. Subsequent !C's are ignored.

The !C command is also used to initialize TTPM2 after a power ON. If existing print layout shall be saved, !P shall be used for printer initialization. See *TTPM2 Start-Up* *on page 59*.

If no fixed data is used on the tickets, Autoclear can be used to clear the memory between tickets instead of using !C. Autoclear executes faster than !C. When autoclear is enabled any !C commands in the received data will be ignored, apart from when initiating the printer. Setting DIP-switch 4 to ON enables Autoclear.

- !CA, adding an A to the !C command enables extended acknowledgement.
- !C1, adding the digit 1 to the !C command clears the wastebasket counter. See !Y1.

!P	Print

This command effects both the encoding, printing, cutting and ejecting of a ticket.

Printing follows a successful encoding. The magnetic code and print information, as well as cut and eject behavior, must first be defined using the applicable commands.

The Print command can also be used to initialize the TTPM2 after power OFF (as an alternative to !C) in order to save any ticket layout stored in the TTPM2. See *Additional Commands* *on page 29* and *TTPM2 Start-Up* *on page 59*.

If !P is received and the printer is out of paper, it will give error code NAK P and discard the received data.[3]

3. Introduced in firmware in version 4.13

Encoding Retries

Adding a single digit after the !P makes it possible to set the maximum number of encoding retries for one ticket. The number given is the number of additional tries i.e. !P 1 means one normal attempt plus one retry. Default is 1, which is the value used if no digit is present.

Eject to Waste Basket

Adding an @ character (!P@) makes the printer eject the completed ticket into wastebasket (for FL2 and FL3 printers). One use for this can be to make status printouts that are not intended for the customer.

Eject Fully

Adding an E (!PE) makes the printer eject the ticket fully so that it can fall down into a tray (for FL3 printers)[4]

Digits and @, or digits and E can be mixed on the same line, for example !P5@ makes five encoding retries, and ejects the ticket into the wastebasket.

Set Print Speed

Adding letters S, M, or F adjust the print speed:[5]

!PS	Print slow
!PM	Print medium
!PF	Print fast.

Print quality is very much dependent on speed. The normal print speed is used unless you select Fast or Slow with this command.

!Q	**Write transaction string**

!Q writes a string with up to 15 ASCII characters to a buffer memory in the printer.

Example: `!Q asdfgh <CR><LF>`

After the ticket has been correctly encoded/printed, the string is copied to a buffer in the battery backed up RAM. This buffer can be read by the !V-command.

The transaction string is committed at the precise point where a useable ticket has been produced. The only way to reset a transaction string is to successfully print another useable ticket that was initiated with !Q. Loss of power or a reset or any other instruction leaves the string intact.

4. Added in firmware version xxxxx-399s

5. Added in 3.39zb

!S	Status request

The TTPM2 responds by sending two bytes to the host computer. Byte 1 indicates the status of the various TTPM2 sensors according to the following table. Byte 2 reports the temperature of the thermal print head and is only used internally in the TTPM2.

Bit	Function	Sensor	Value “1”	Value “0”
0	Lower rear document entry	J6	Paper present	No paper
1	Upper rear document entry	J7	Paper present	No paper
2	Top-of-form	J8	Paper present	No paper
3	Cutter position	J9	Paper present	No paper
4	After cutter position	J10	Paper present	No paper
5	Cutter	J21	Cutter home	Cutter not home[a]
6	Print head	–	OK	Error
7	Front Load Sensor	J11	Paper present	No paper

a. On CD200 versions with “card level low” sensor, this bit indicates low card level. (printer version 02441-002, 5600-A0015)

See also: ENQ

!SD	Status request, DIP-switch settings

The TTPM2 responds with one byte containing 1 bit for each switch. 1 = on, 0 = off.

Bit	7	6	5	4	3	2	1	0
Dip switch No:	8	7	6	5	4	3	2	1

!U	Firmware version query[a]

a. Introduced in firmware version 3.2

The TTPM2 responds by sending the following string:

00906_320 TTPM2 Ticket Printer/Encoder

Where 00906 is the firmware number for the TTPM2 standard, and 320 is the firmware revision, in this case 3.20.

!V	Read transaction string[a]

a. Introduced in firmware version 3.32

Reads the string stored by !Q from the memory in the printer.

!W	Read thermal print progress indicator[a]

a. Introduced in firmware version 3.32

Reads a value indicating the number of bytes actually printed on the ticket (both blank and non blank). The number consists of 4 hexadecimal digits and should normally be equal to 5BE0. A lower number together with the absence of the 03H indicates that the last ticket was not fully printed and a decision may be taken whether the system should reissue the ticket or alert the supervisor.

This is a safety feature to minimize the risk of valid tickets being duplicated without attention from the system, by turning off the power at a certain point.

!X	Set resolution

Sets the resolution of the print. This only affects the resolution in the transport direction of the ticket. 0=normal resolution, (5.7dots/mm). 1=high resolution (8.5 dots/mm).

!Y	Read ticket counter[a]

a. Introduced in firmware version 3.60

Reads out the internal ticket counter from the control board. This counter starts from 0 when the printer is new and is incremented by one fore each completed !P sequence.

The result is sent as 12 decimal digits + CR + LF

!Y1	Read retract counter[a]

a. Introduced in firmware version 4.24

Reads out the internal retract counter. This counter is incremented by one for each ticket that is retracted and thrown in the wastebasket.

To reset the counter to zero, send the command:

C1

The result is sent as 12 decimal digits + CR + LF

Note • Retract function is only available on printers with FL2 and FL3.

!Z	Burn time[a]

a. Introduced in firmware version 3.84

Setting	Burn time		Print density	
16	512	µs	Test	Lightest print
17	544	µs	Test	
18	576	µs	Test	
19	608	µs	Test	
20	640	µs	Test	
21	672	µs	Test	
22	704	µs	Test	
23	736	µs	Test	
24	768	µs	Test	
25	800	µs	Test	
26	832	µs	Test	
27	864	µs	Test	Default
28	896	µs	Test	
29	928	µs	Test	
30	960	µs	Test	
31	992	µs	Test	Darkest print

The burn time controls the print density. It is used to set the heating so that it is adequate for the thermal paper used as ticket material. Set it to the lowest burn time that gives acceptable print quality.

Example • !Z 20 <CR><LF> sets burn time 640 µs

The burn time setting is stored in the non-volatile memory.

A three-button reset returns the setting to default value.

Caution • A longer burn time puts more load on the printhead, so do not use a longer burn time than required for a clearly legible print. Settings over 27 are not recommended.

ENQ	Status request, immediate

The TTPM2 responds by sending the same 1 byte response to the host computer as is sent as byte 1 in response to the !S command. The ENQ command is effected immediately after receipt, whereas the !S command is effected in sequence when received.

TTPM2 has two feed motors, one for encoding and one for printing.

!F A	Feed- acceleration and speed[a]

a. This command was introduced in firmware version 4.49d

This command sets the start-frequency and the top speed of each motor.

Note • This command should not be used! Suitable speed is selected by Zebra and set as default parameters in the firmware. The speed setting has to reflect the motors fitted in the printer and the mechanical buildup of the printer. A single unit may be tunable to a higher speed but it is not certain that the settings work on the next printer.

Note • A three-button reset will set the values to factory default.

Syntax for defining and downloading graphics data is as follows:

!F A N <start freq> <top speed> <motor> 1 1 1_”remark”

!F	Command to load print-parameter information.
A	Indicates acceleration and speed mode.
N	Print orientation. This is ignored in acceleration and speed mode. Orientation is always North (N). The printer requires the N to be inserted.
<start freq>	Start frequency. Set the base frequency from where the acceleration starts. A value of 30 indicates a start frequency of 300 Hz.
Top speed	Top speed is the frequency at which the acceleration stops. A value of 450 sets top speed to 4500 Hz.
motor	“1” selects encoding motor, while “2” selects print motor
1	Not used. Must be set to 1.
1	Not used. Must be set to 1.
1	Not used for graphics printing. Must be set to 1.
space	One space has to follow the "1" before the graphics data.
Remark	Here you can enter a remark describing the setting you just did. It will not be printed.

Example •
!C<CR><LF>
!F A N 30 250 **1** 1 1 1 "Encode speed (full-step)"<CR><LF>
!F A N 30 190 **2** 1 1 1 "Print speed (half-step)"<CR><LF>
!P<CR><LF>

Document-Entry Related Commands

!A	Set ticket length for roll paper[a]

a. This command was introduced in firmware version 4.55

This command sets the ticket length if paper without gaps or black marks is used. One step is 0.7mm.

`!A 127`	sets up a credit car sized ticket length.
`!A 0`	turns off the function and reverts to gapped ticket stock. This is the default setting.

The mechanics of TTPM 2 works with ticket lengths between 54 and 120 mm.

E	Eject through rear document entry

This command ejects, through the rear document entry, any document positioned in the active position for encoding (or after decoding). See *Single-Ticket Handling* *on page 71* for the definition of active/ standby ticket position.

!L1	Select lower rear document entry (dual entry printers only)

Selects lower rear document-entry and feed the leading document, in the consecutive supply entry, to active position. If, in the preceding operation, the upper rear document entry has been engaged, the document in that entry is retracted from the active position.

Note • On dual document entry printers, a ”select rear entry” command (!L1, !L2, !L17 or !L18) must precede the print command (!P). An ACK character is returned if the command was successful. If no paper is present, the yellow indicator lights up and the printer waits until the operator insert new paper stock.

Note that DIP switch no. 6 must be set to ON to enable the ACK/NAK signaling.

See alternative command !L17.

!L2	Select upper rear document entry (dual entry printers only)

Same function as !L1, but selects upper rear document entry.

See alternative command !L18.

!L3	Load document from front entry (front load printers only)

This command lifts the print head for a specified time, to permit document insertion through the TTPM2 front document entry/exit. At the same time, any document in active position is retracted. The document inserted in the front document input/exit is loaded into the printer and placed in active position in the upper entry, see *Single-Ticket Handling* *on page 71*.

To speed up ticket handling, the magnetic code of track two is read and placed in memory when loading the ticket. !D will read track two data from memory without having to move the ticket. Reading track one (!D1), or track three (!D3), requites a ticket read movement (from active position, to the output module, and back again).

On error, the TTPM2 sends the following error codes to the host computer:

Error code	Error
NAK+B	No document is inserted within 60 seconds. Command !L3 is abandoned.
NAK+C	A document is inserted and immediately retracted.
NAK+D	A document is inserted, but the TTPM2 is blocked (paper jam)
NAK+E	Paper jam in the input feeder during an !L3 command.

A front loaded document resting in active position can be processed using one of the following alternatives:

- Using the appropriate decode command !D, !D1, !D3 or !O.
- Using print parameter format command !F and applicable encoding command !I, !J, !K, !M or !N, followed by print command !P.
- Document Related Commands !E, !L4 and !L5.

!L4	Eject document through front document entry (only already cut ticket)

A document positioned in the active position is ejected through the front document entry, without encoding or printing.

Compare with the !E command that ejects the document through the upper rear document entry.

!L5	Eject document into waste bin (only printers w. waste bin)

Only for printers with front load 2 (with waste bin): This command transports the ticket from active position to the waste bin. The same function can be obtained for cancelled tickets if character ”@” or a “}” is inserted into the string of data to be encoded.

!L17	Select lower rear document entry and signal paper out (only dual entry printers)

Same function as !L1, but when ticket loading fails the printer sends an error code (NAK + '1') instead of waiting for paper to be loaded. It is then up to the system to determine if paper should be loaded from the upper document entry instead.

!L18	Select upper, rear document entry and signal paper out (only dual entry printers)

Same function as !L2, but when ticket loading fails the printer sends an error code (NAK + '1'). It is then up to the system to determine if paper should be loaded from the lower document entry instead.

!T	Sets timeout for retract function (only printers w. waste bin[a])

a. Introduced in firmware version 3.75

!T@nn

nn is the delay in seconds

When a ticket is left in the output of the front load after the timeout nn has expired, NAK F is sent to the host controller to indicate that the ticket hasn't been picked up.

If the customer takes the ticket before the timeout elapses, the printer sends a Bel (07H) character.

@ Expands the signaling: If you have a Front load with waste basket function, the printer retracts the uncollected ticket and ejects it into the wastebasket exit.

Note • The !T command should be sent after the !P (print) command. DIP-switch 6 must be ON for status replies to be sent.

Example •

!P
!T @20
Retracts the ticket and sends `NAK F` if it has not been taken within 20 seconds

Example •

!P
!T 20
Sends `NAK F` if the ticket if it has not been taken within 20 seconds

Both examples above sends `BEL` if the ticket is taken

Print Related Commands

Introduction

!F is the general command for formatting the ticket print.

!F<type> <data>

The parameters are used as follows:

!F	Indicates that this is the start of a print field definition
<type>	Specifies the type of the field
T =	Text
G =	Graphics
M =	Ticket cancellation definitions (See *Canceling a Ticket* *on page 49*)
C =	Bar code
<data>	Depends on the type of field specified. See the following pages.

Text Printing

!F T	Format text for printing

Example •

!F T <orientation> <xpos> <ypos> 1 <height> <width> <font> <"text">

The parameters are used as follows:

!F	Indicates that this is the start of a print field definition
T	Indicates text mode
<orientation>	Specifies the way in which the text is to be oriented. This can be either N(orth), E(ast), S(outh) or W(est). This terminology is described in detail in the examples given in this document. Specific fonts may be limited to one orientation only, see <font> below.
<xpos> <ypos>	Specifies starting position for the text on the ticket. That is, the distance in pixels from the upper left corner of the printable area to the upper left-hand pixel of the first character to be printed. Note that the resolution is 7.52 pixels/mm on the X-axis and 5.7 pixels/mm on the Y-axis in normal, and 8.5 pixels/mm on the Y-axis for high resolution, see command !X.
<fixed pitch>	No. of pixels from the start of one character to the start of the next. Range 6 to 16. A value below 6 sets the default pitch. [a]

a. Introduced in firmware version 3.2

Note • Only used for font 1. Must be set to 1 for all other fonts.

<height> <width>	Specifies the height and width expansion of characters to be printed. The height range is 1–16 times the default value. The width range is 1–16 for fonts 1 and 4, and 1–3 for fonts 2 and 3. See the font samples in *Printing and Encoding Capability Overview* *on page 25*.
<font>	Selects the font (text appearance). Fonts 1, 2, 3, and 4 apply. Font 2 and 3 can only be North oriented. Fonts 1 and 4 can be set to any orientation. Font 4 is a proportional character font. See the font samples in *Printing and Encoding Capability Overview* *on page 25*. Font appearance may differ from the font samples if you have custom firmware in your printer.
<"text">	Text to be printed, or definition of a variable text field. Both plain text and variable definitions have to be enclosed in quotes (" "). Variable data to be printed as plain text is represented by "%V" in the format data string. The information that should replace the variable are sent before the !P print command at printout time. See *Document Examples* *on page 61*.

Example • Example of a command for fixed text:

```
F T N 150 150 1 1 1 1 "Text"↵
```

Example • Example of a command for variable text:

```
F T N 150 150 1 1 1 1 "%V"↵
```

Graphics Printing

!F G	Format graphics for printing

TTPM2 can print bit map graphics. Graphic images are stored in the fixed memory area and will therefore be repeated on every ticket until the next !C command is received.

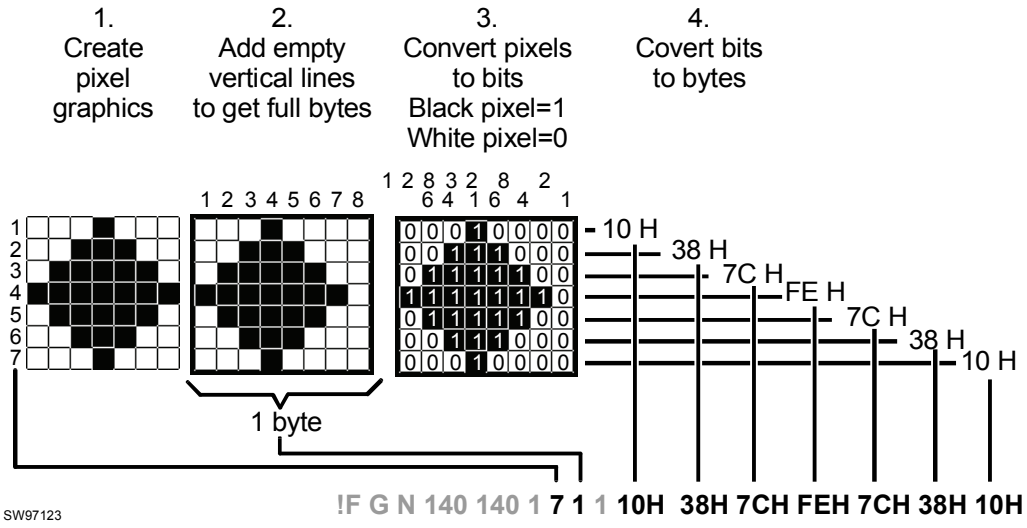
Remember, when creating graphics for the TTPM2 printer, that the pixels are not square but have a height/width ratio of 1.32:1.

Syntax for defining and downloading graphics data is as follows:

!F G <orientation> <xpos> <ypos> 1 <height> <width> 1_<Graphic_data>

!F	Command to load print-parameter information.
G	Indicates graphics mode.
<orientation>	Print orientation. This is ignored in graphics mode. Orientation is always North (N). The printer requires the N to be inserted.
xpos	Horizontal starting position in pixels for the upper left-hand corner of the graphics block. Position will automatically be rounded off to be divisible by 8 as a graphic block has to start at the first bit in a byte.
ypos	Vertical starting position in pixels for the upper left corner of the graphics block.
1	Not used for graphics printing. Must be set to 1.
height	Height in pixel lines of the graphic block. The length of the ticket determines maximum height. For an 86 mm ticket the maximum height is approximately 500 pixel-lines.
width	Width **in bytes** of the graphic block. Maximum width is 48 **bytes**.
1	Not used for graphics printing. Must be set to 1.
space	One space has to follow the "1" before the graphics data.
Graphic_data	This is a block of bit mapped graphics data. The block is stored in the printer starting at <xpos>, <ypos>. The numbers of bytes specified by <width> are stored in one pixel line. The <ypos> is then incremented and the next line is stored. This is repeated <height> number of times. It is up to the user to send the correct number of bytes to the printer, that is, <height> × <width>, as the printer will scan the input character stream for the correct number of bytes.

Figure 16 • Converting graphics to TTPM2 format.


1. Create pixel graphics
2. Add empty vertical lines to get full bytes
3. Convert pixels to bits Black pixel=1 White pixel=0
4. Covert bits to bytes
1 2 3 4 5 6 7 8
1 2 8 3 2 8 2
6 4 1 6 4 1
1 byte
10 H
38 H
7C H
FE H
7C H
38 H
10 H
SW97123
!F G N 140 140 1 7 1 1 10H 38H 7CH FEH 7CH 38H 10H

Note • The appearance on your screen depends on the editor you use to write your program.

A file for downloading and printing the above graphics will look like this, in Windows Notepad:

```
!C
!C
!F G N 140 140 1 7 1 1  8|þ|8  !C
!C
!L1
!P
```

A utility program called TTPM editor can help you convert Windows bitmap images (BMP-files) to TTPM graphics format. You can download the TTPM editor free of charge from the Zebra Internet web site at http://www.zebra.com.

Printing Bar Codes

!F C	Format bar code printing

Bar code printing can be used as ticket data carrier instead of, or in addition to, magnetic encoding.

Note • To produce sharp code bars, the TTPM2 printer automatically reduces the print speed by approx. 50% when printing tickets with east and west oriented bar codes. In firmware version 3.50 and higher, this speed reduction is only valid for bar widths 1 and 2. Wider bar codes are printed at full speed.

Bar code data is treated as fixed data. You can however replace a bar code by overlaying the previous data with new bar code data on the same X- and Y-coordinates. This way you avoid deleting the complete ticket with a reset (!C) when you want to update the bar code.

The syntax for defining and downloading of bar code data is as follows:

```
!F C <orientation> <xpos> <ypos> <bar 1> <height> <bar 2>
<type>_ <”bar code data”>
```

!F	Command to load print parameter information
C	Indicates bar code mode
<orientation>	Indicates print orientation. Can be north (N), east (E), south (S), or west (W).
xpos	Starting position (pixel) for the upper, left-hand corner of the first code bar in the string. Automatically rounded off to be divisible by 8, (first bit in a byte).
ypos	Starting position (pixel) for the upper, left-hand corner of the first code bar
Bar 1	Width in pixels of both black and white bars, range 1–16. For EAN13 and EAN/Code 128 the value must be set to 1. For Code 39 and Code 2-of-5 this sets the wide bars.

height	Code bar height in pixels			
	Value	1 =	16 pixels =	2.7 mm
		2 =	32 pixels =	5.3 mm
		3 =	48 pixels =	etc.
		4 =	64 pixels =	
		5 =	80 pixels =	
		...		
		16 =	256 pixels =	42.7 mm

Bar 2	Width in pixels of both black and white bars, range 1–16. For EAN13 and EAN/Code 128 the wide/narrow ration is fixed and this sets the width of the entire code. For Code 39 and Code 2-of-5 this sets the narrow bars.

type	selects type of bar code. The following types are available:		
	Value	1 =	EAN13 (partly implemented, no check sum)
	Value	2 =	Code 2-of-5 interleaved
	Value	8 =	EAN 128[a]
	Value	9 =	Code 128
	Value	11 =	Code 39

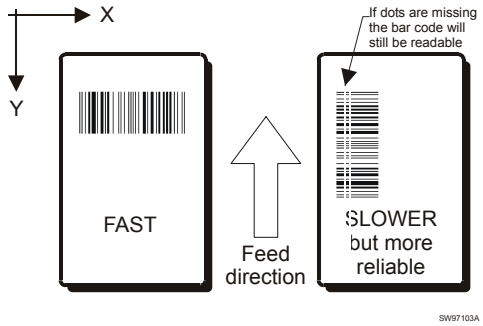
a. Code 128 and EAN 128 are only implemented in firmware 00970-xxx, and it replaces font 2.

space	A space (blank) has to be inserted between the type parameter and the data string.
bar code data	This is a block of data to be converted by the TTPM2 and printed in bar code form in accordance with the parameters identified. For available characters and data string formats, please refer to the specific type of bar code.

The following command string produces the ticket illustrated below:

```
!C
!L1
!F C N 12 102 1 4 3 1 "1234567890128"
!P
```

Figure 17 • EAN13 bar code. Use east or west oriented bar codes wherever possible, to guarantee readability.



Example • Code 39 example:

```
!F C N 100 230 6 2 2 11 "12345"
```

Example • Code 128 example[1].

```
!F C N 100 320 1 5 2 9 "abc123"
```

Example • Code 2-of-5 example

```
!F C N 100 410 5 2 2 2 "123456"
```

Note • Code 2-of-5 must have an even number of digits.

Canceling a Ticket

!F M	Format print on cancelled ticket

The TTPM2 can cancel a ticket after an unsuccessful magnetic encoding. The feature relates to the read-after-write function[6]. When the <message> has been encoded, the TTPM2 reads and compares the magnetically encoded message with the original <message> string. If the comparison is negative, a second attempt to encode/read the same ticket is done. If also this attempt is negative, the ticket is cancelled. The magnetic stripe is erased and stripes are printed across the ticket (see figure below).

By default the TTPM2 attempts to encode three tickets. The desired number of attempts, as well as the text used to indicate the cancellation, is programmable through a subcommand to the !F command as follows:

!F M <orientation> <xpos> <ypos> <attempts> <height> <width> <font> <”text”>

All parameters must be specified.

The syntax is identical to !F T with the exception of the parameters <”text”> and <attempts>.

Text must be a text string. Variables cannot be used with !F M.

Attempts are the number of tickets the TTPM2 should attempt to encode. If <attempts> is set to 1, the TTPM2 will make only one attempt (plus the automatic second attempt on the same ticket) to encode the ticket. If this fails, <text> will be superimposed on the ticket that is now being printed.

Setting <attempts> = 2 results is one striped ticket (first unsuccessful attempt) and the superimposed text for the second unsuccessfully attempted ticket and so on.

It is also possible to set how many times the printer should try to verify each ticket by adding a single digit after the !P command. This is described in the !P command description.

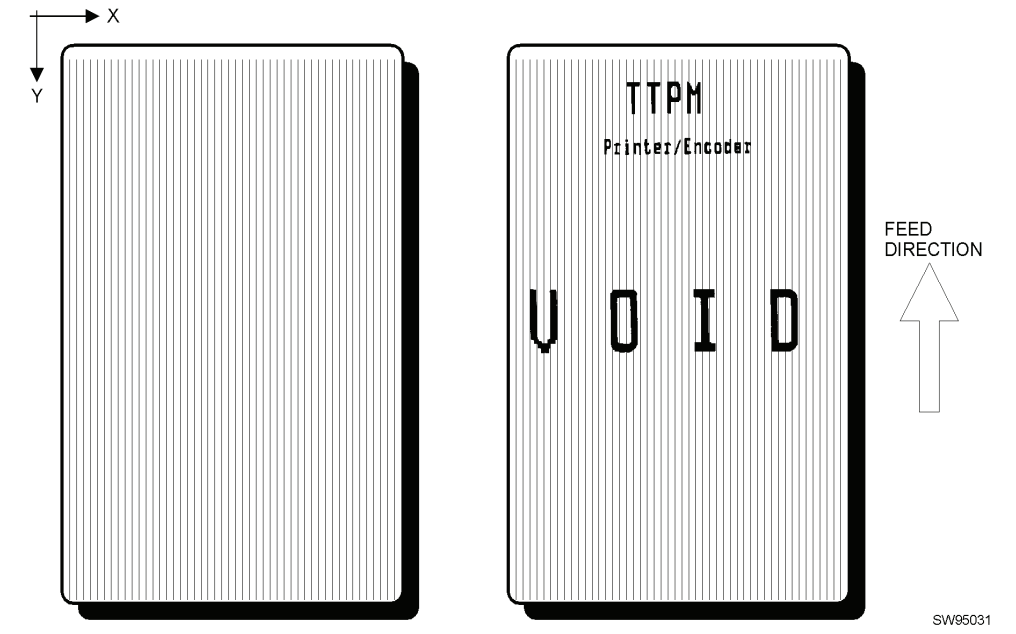
All parameters in this command are stored in battery backed-up memory and remain in effect until overwritten.

The following command string produces the tickets illustrated below at 2 unsuccessful encoding attempts:

```
!F M N 20 200 2 8 8 1 "VOID"
```

6. Inserting an asterisk (*) in the data string to be encoded disables the read after write feature, see *Introduction* *on page 7*.

Figure 18 • Indication of 1st and 2nd unsuccessful read-after-write



Magnetic Encoding- and Decoding-Related Commands

Track number and type of encoding (ISO standard or hexadecimal bit-by-bit) is determined by the encoding command used as specified below:

Encoding

Syntax <command><message>↵

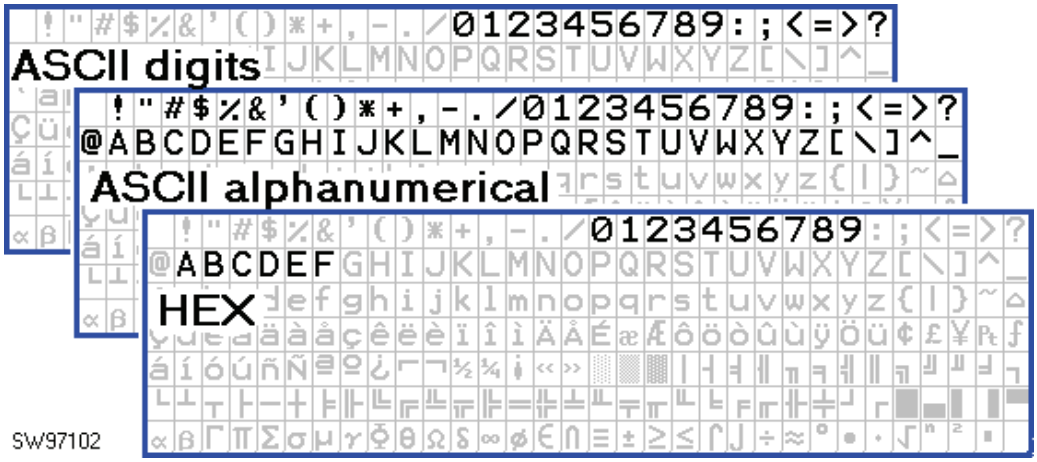
!M000000016↵	Encode command				
	!I	**!J**	**!K**	**!M**	**!N**
Track 1 (only on track 1&2 printers)		X	X		
Track 2 (or center track)				X	X
Track 3 (only on track 2&3 printers)	X		X		
BPI	210	210	210	75	75
Coding					
ISO 7811	X	X		X	
HEX			X		X
Message length					
ASCII digits (30H to 3FH)	123			37[a]	
ASCII alphanumeric (20H to 5FH)		79			
HEX (0 to F)			123		50[b]
No. of sync. zeros before code start[c]	Auto	Auto	³15	Auto	³6
Automatic start, stop and check digits	X	X		X	
Read command	**!D3**	**!D1**	**!O1, or !O3**	**!D, or !D2**	**!O, or !O2**

a. Custom version with 161 bpi can encode 89 ASCI digits.

b. Custom version with 161 bpi can encode 112 HEX characters and need 12 start hex zeroes.

c. Trailing zeroes are automatically added by the printer, DO NOT add trailing zeroes in the message string!

Figure 19 • This figure shows which characters can be coded with the different coding formats



Note • With HiCo encoding, only one track at a time can be used for encoding or reading. In this case, code first track with | or $ in the magnetic string to return the ticket to active position after coding, then reset the printer with !C, and code the other track and print the ticket.

Checksum

To ensure correct reception of the message to be magnetically encoded, a checksum can be appended to the data by the host computer. This checksum will then be compared by the TTPM2 before encoding which guarantees that the magnetic code data is correctly received.

Calculate the checksum as the modulo 2 sum (consecutive XOR) of the ASCII data bytes sent in the !M command. The checksum must have bit 7 set to 1 to distinguish it from ordinary data.

Append the checksum at the end of the !M data string when encoding ISO data at track 2 (or center track).

When the message has been received, the TTPM2 calculates the checksum and compares it to the checksum appended to the message. If they are identical, an ACK is returned, otherwise a NAK followed by the checksum calculated by the TTPM2 will be returned.

The checksum is never encoded on the magnetic stripe; it is only intended to secure data transmission. The ISO format itself automatically adds a check digit to the magnetic code.

Reading and Decoding

The ticket is taken from active position, and after reading, the ticket returns to active position.

!D	Reads and decodes ISO track 2 (or center track) and transmits the data to the host computer.
!D1	Reads and decodes ISO track 1 and transmits the data to the host computer.
!D3	Reads and decodes ISO track 3 and transmits the data to the host computer.
!O	Reads and transmits bit-by-bit data, from ISO track position 2 (or center track), to the host computer. No decoding takes place in the TTPM2. A one is transmitted as ASCII 1, and a zero as ASCII 0.

Magnetic Encoding Attributes[7]

The magnetic encoding data strings can be given attributes that govern versions of the standard encode/read-after-write routines and cancellation functions.

The following attributes, inserted anywhere in the applicable data strings, will cause the following functional deviations from default standards:

Note • The attributes in parenthesis only work for the !M command

{ (or *)	Cancels the read-after-write function. The ticket is encoded and directly transported forwards for separation (if applicable) and subsequent printing according to the !F command data without prior read-after-write.
| (or $)	Encodes the ticket, performs read-after-write, but does not transport the ticket for printing. Instead, the ticket is backed into the active position without being cut, waiting for the command to proceed, for instance, for a decode operation.
} (or @)	Expands the read-after-write operation. If this is successful, the ticket is processed in accordance with standard routines, that is, it is separated and printed. If the read-after-write operation is unsuccessful in the programmed number of attempts, the ticket is transported forwards, and the waste bin of the front load mechanism is activated (only printers with front load & waste bin option). The ticket is dropped into a waste bin.
|} ($@)	Combining the characters | and } results in normal behavior if the encoding was successful. If an error occurs then the ticket is transported back to the start position and NAK + 'E' is sent.

7. {, | and } was introduced in firmware version 3.2, and ~ in version 3.96

~	Encodes the ticket, performs read-after-write, and cuts the ticket. The ticket stops after the cutter (where the after cutter sensor still can see the ticket). Here it waits for print data and !P command before proceeding to be printed and ejected to the customer
	Apart from print data and !P, only the following commands are allowed. !L3, !L4, and !L5.
	!L5 "Eject document into waste bin" will throw away the ticket from the waiting position into the waste bin without erasing the data to avoid that the ticket material in the upper track is being pushed out.
—	(minus sign) Disables encoding on magnetic retries. If magnetic retries occur it is almost certain that it is the read-after-write fails due to interference. If encoding is disabled on the retry, the interference level is drastically reduced and the possibility of a successful reading increases. This is especially useful for HiCo tickets.

Magnetic Encoding Retries

See *Canceling a Ticket* *on page 49*.

Encoding Examples

Example • Encoding two tracks on a HiCo ticket:

```
!C«»
!M 12345678901234567890123456789012345678901234567 |«»
!P«»
!C«»
!J  ON TRACK 1 YOU CAN ENCODE UP TO 79 ASCII
ALPHANUMERICAL CHARACTERS AND DIGITS«»
F T N 50 140 1 1 1 3 "HiCo Test" «»
!P«»
```

Note • The | character in the string makes the ticket return to active position after encoding this track

What Can You Encode?

Track 1 ISO Encoding

ASCII	Character	Parity	Mag-code	
32	Space	1	000000	
33	!	0	000001	Character not defined in Standards
34	"	0	000010	Character not defined in Standards
35	#	1	000011	
36	$	0	000100	
37	%	1	000101	Start Character (Start Sentinel)
38	&	1	000110	Character not defined in Standards
39	'	0	000111	Character not defined in Standards
40	(	0	001000	
41	)	1	001001	
42	*	1	001010	Character not defined in Standards
43	+	0	001011	Character not defined in Standards
44	,	1	001100	Character not defined in Standards
45	-	0	001101	
46	.	0	001110	
47	/	1	001111	
48	0	0	010000	
49	1	1	010001	
50	2	1	010010	
51	3	0	010011	
52	4	1	010100	
53	5	0	010101	
54	6	0	010110	
55	7	1	010111	
56	8	1	011000	

57	9	0	011001	
58	:	0	011010	Character not defined in Standards
59	;	1	011011	Character not defined in Standards
60	<	0	011100	Character not defined in Standards
61	=	1	011101	
62	>	1	011110	Character not defined in Standards
63	?	0	011111	Stop Character (End Sentinel)
64	@	0	100000	Character not defined in Standards
65	A	1	100001	
66	B	1	100010	
67	C	0	100011	
68	D	1	100100	
69	E	0	100101	
70	F	0	100110	
71	G	1	100111	
72	H	1	101000	
73	I	0	101001	
74	J	0	101010	
75	K	1	101011	
76	L	0	101100	
77	M	1	101101	
78	N	1	101110	
79	O	0	101111	
80	P	1	110000	
81	Q	0	110001	
82	R	0	110010	
83	S	1	110011	
84	T	0	110100	
85	U	1	110101	
86	V	1	110110	
87	W	0	110111	
88	X	0	111000	

89	Y	1	111001	
90	Z	1	111010	
91	[	0	111011	Character not defined in Standards
92	\	1	111100	Character not defined in Standards
93	]	0	111101	Character not defined in Standards
94	^	0	111110	Field Separator
95	_	1	111111	Character not defined in Standards
Mag Code = the six LSB of (ASCII value - 32), parity bit is added by printer.				

Track 2&3 ISO Encoding

ASCII	Charac-ter	Parity	Mag-code	
48	0	1	0000	
49	1	0	0001	
50	2	0	0010	
51	3	1	0011	
52	4	0	0100	
53	5	1	0101	
54	6	1	0110	
55	7	0	0111	
56	8	0	1000	
57	9	1	1001	
58	:	1	1010	Account Separator (Track 3 only)
59	;	0	1011	Start Character (Start Sentinel)
60	<	1	1100	
61	=	0	1101	Field Separator
62	>	0	1110	
63	?	1	1111	Stop Character (End Sentinel)
Mag Code = the four LSB of (ASCII value - 48), parity bit is added by printer.				
Sending !M12345 to the printer results in encoding of 00000;12345?000000				
This results in:				
00000000000000000000000001011000100100011010000101011001111				

6

TTPM2 Start-Up

The TTPM2 has battery backed-up memory. All print field definitions are retained even when the printer power is switched OFF.

Power Failure Cleanup[8]

At power ON, the TTPM2 tries to find out if a ticket is in the ticket path at any other location than at the top of form position. If it finds a ticket, it destroys the magnetic encoding, prints VOID on it and outputs the ticket. If the printer is equipped with a front load 2 or 3 unit, the ticket is redirected to the waste bin.

Start-Up Synchronization

To enable the TTPM2 to synchronize itself to the incoming data after power up, either after a usual power ON, or after a power failure, the printer has to receive either a !C command that it will execute, or a !P command that it will ignore.

Using the !C command to initiate the TTPM2 clears all data that has previously been stored. To avoid having data cleared, the !P command can be used, for example, to retain document data stored in the TTPM2 prior to a power failure or power OFF.

Note • Please remember that the TTPM2 has to receive either the !C or !P command, or both, after power up. All other commands and data will be ignored.

8. This feature was introduced in firmware 1660-xxx version 3.30, and in version 4.11 for other firmware.

Notes • _____

7

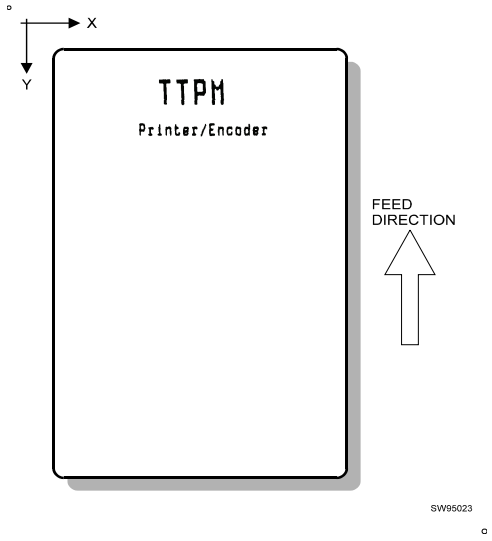
Document Examples

The command language will be explained in detail with the following examples.

Note • These examples are for single-entry TTPM2 printers. If you have a dual entry printer you must insert a !L1 command on a separate line before the !P command.

Assume that you want to print a document with the following layout and the number 123456789 to be encoded on ISO track 2 (or center track).

Figure 20 • Printout example



To achieve this, the following data have to be sent to the printer:

```
!C
!C
!F T N 150 20 1 2 2 1 "TTPM"
!F T N 110 70 1 1 1 1 "Printer/Encoder"
!M 123456789
!P
```

This command sequence will now be fully explained:

`!C`	Clears all previously sent definitions.
`!F T N 150 20 1 2 2 1 "TTPM"`	Defines a print field starting at X coordinate 150, (pixel pos. 150), Y coordinate 20 (pixel pos. 20), with characters of double height and double width, font 1. X-axis resolution is 7.52 pixels/mm (0.133 mm/pixel), Y-axis resolution is 5.7 pixels/mm (0.175 mm/pixel)
`!F T N 110 70 1 1 1 1 "Printer/Encoder"`	Defines a print field at X pos. 110, Y pos. 70 with standard size characters, font 1.
`!M 123456789`	Defines data to be encoded in ISO defined format on ISO track 2 (or center track) magnetic stripe as "123456789". Reads the encoded string, compares with the input (read-after-write)

Note • For ISO encoding, start, stop and check digits, as well as synchronization zeroes are automatically added by the TTPM2.

`!P`	Encodes and prints the document. The "!F" definitions are now stored in the printer. If another document with the same text and layout shall be printed but with another magnetic data string then only the following commands need be sent to the printer: `!M987654321`
`!P`	This sequence will encode a ticket with a different number on the magnetic stripe but will produce a print picture with the same text and layout as the previous one.

Note • If data shall be encoded on track 1 or 3, use the applicable command !J or !K to precede the data. The same Encoding/Read-after-Write routine applies as for track 2 (or center track) encoding.

Two tracks can be encoded in the same operation unless the printer uses HiCo tickets.

!J <message> and !K <message> for encoding track 1 or 3 shall precede the !M <message> and !N<message> for simultaneous encoding/read-after-write of message data on tracks 2 and 1/3.

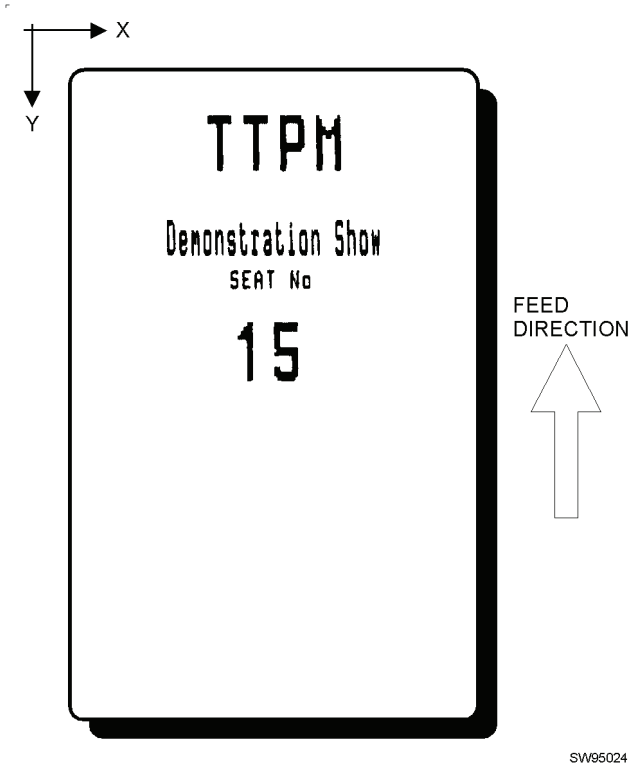
Note • X position range is 0–380 (at North orientation) Y position range is 0–470 for 86 mm tickets (at North orientation)

Suppose you have information, such as seat number, to be printed and encoded and that the information varies for each individual document. The information shall be placed at the same position on all documents.

Example • This has been slightly changed from the previous example. The seat number (15), changes for every document printed and encoded while the rest of the information remains the same. To achieve this, the following command sequence has to be sent to the TTPM2:

```
!C
!C
!F T N 130  20 1 3 3 1 "TTPM"
!F T N  90 100 1 2 1 1 "Demonstration Show"
!F T N 150 150 1 1 1 1 "Seat No"
!F T N 150 180 1 3 3 1 "%V"
15
!M0000015
!P
```

Figure 21 • Printout example



The variable information additions to the previous example are:

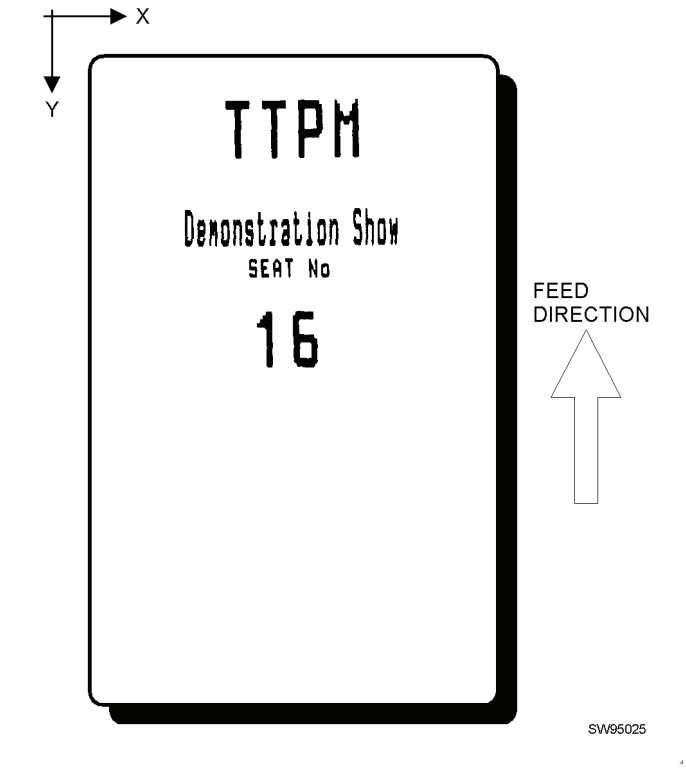
`!F T N 150 180 1 3 3 1 "%V"`	This defines a variable text field that will be filled with data sent to the printer prior to the print command. The contents of the field will be erased after printing. The field definition, however, is not erased.
`15`	These are the characters that will be printed in the variable text field defined above.
`!M0000015`	0000015 is the data string to be encoded on the magnetic stripe. !M instructs the printer to use track 2, and ISO code the message with a density of 75 bits/inch.

To print and encode a document with the seat number 16 all we have to do is to send the following to the printer:

```
16
!M0000016
!P
```

This will then produce the following printout.

Figure 22 • Printout example



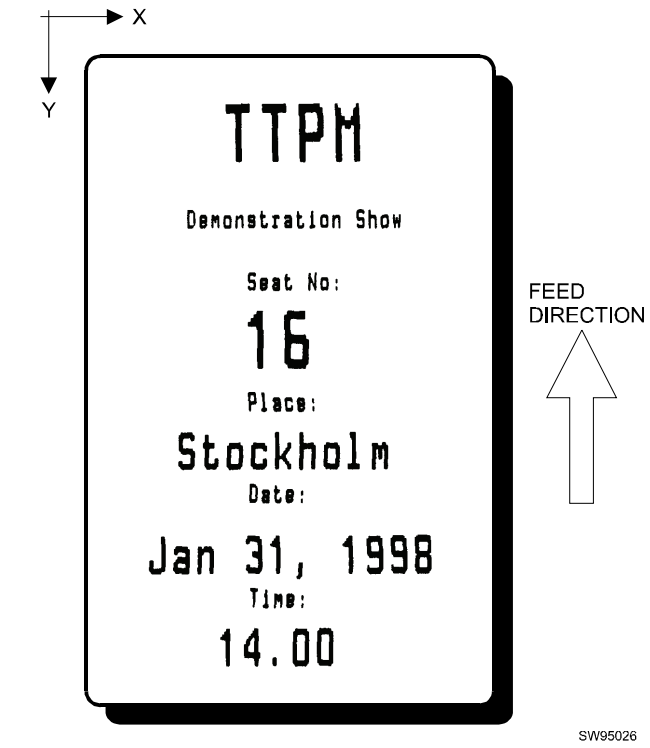
This Demonstration Show will, of course, be held at many different locations and at different dates and times. It is therefore necessary to define variable information print fields for seat number, place, date, and time.

The following command sequence achieves this:

!C	Fixed information to be printed
!C	
!F T N 130 20 1 3 3 1 "TTPM2"	
!F T N 90 100 1 2 1 1 "Demonstration Show"	
!F T N 150 150 1 1 1 1 "Seat No:"	
!F T N 150 240 1 1 1 1 "Place:"	
!F T N 150 310 1 1 1 1 "Date:"	
!F T N 150 390 1 1 1 1 "Time:"	
!F T N 150 180 1 3 3 1 "%V"	Definitions of fields or variable information
!F T N 80 270 1 2 2 1 "%V"	
!F T N 50 350 1 2 2 1 "%V"	
!F T N 120 420 1 2 2 1 "%V"	
16	Variable information
Stockholm	
Jan 31, 1998	
14.00	
!M980131140016	
!P	

We have now defined six fixed text strings and four variable fields to be sent to the printer. The variables will be assigned in the order they were defined. The following ticket will then be produced.

Figure 23 • Printout example

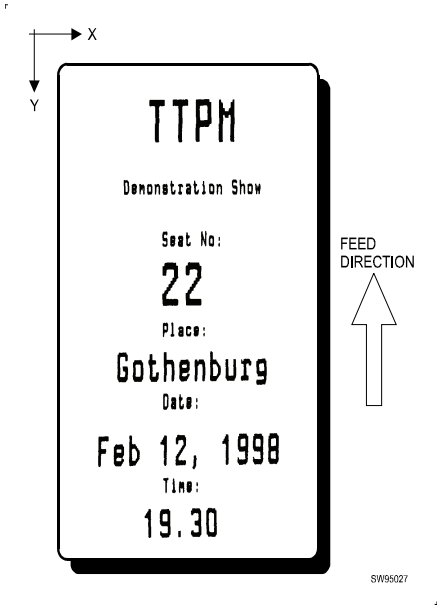


If you need to print a ticket for the show in Gothenburg at another date and time, the following data will have to be sent to the printer:

```
22
Gothenburg
Feb. 12, 1998
19.30
!M980212193022
!P
```

The data results in the following ticket being printed:

Figure 24 • Printout example



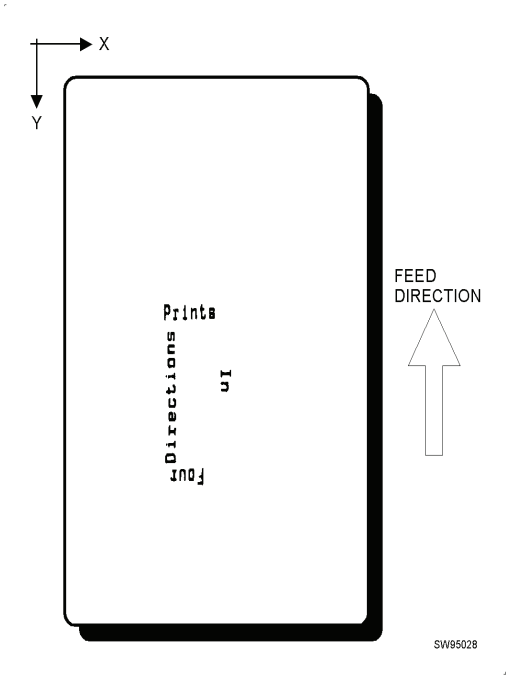
We have so far been printing text oriented in the North direction. The printer is capable of printing in four directions.

Note • Fonts 2 and 3 can only be printed in North orientation.

Example • The following example prints text oriented in all four directions:

!C	
!C	
!F T N 120 190 1 1 1 1 "Prints"	N = North
!F T E 190 250 1 1 1 1 ”In"	E = East
!F T S 170 350 1 1 1 1 "Four"	S = South
!F T W 120 330 1 1 1 1 "Directions"	W = West
!P	

Figure 25 • Printout example



Text Attributes

TTPM2 does not handle word processor-like text attributes. In version 4.07 of the firmware, reversed text has been added, and you can make bold text according to the procedure described below. Bold and reversed cannot be combined.

Printing Bold Text

Bold text is created by repeating the text you want bold, but with new coordinates:

```
!C
!C
!F T E 370 087 10 02 01 1 "This text is normal"
!F T E 309 087 10 02 01 1 "This text is bold"
!F T E 309 088 10 02 01 1 "This text is bold"
!P
```

You can increase the "boldness" by changing the coordinates more than one pixel, or by repeating the text more times with a shift also in the vertical direction.

Reversed Text[9]

Reversed text. If an R character is appended to the font selection digit (no space between), the text is reversed.

```
!C

!C

!F T E 100 110 1 02 02 1R "Reversed text"

!F T E 200 110 1 02 02 1 "Normal text"

!P
```

Note • Only reverse single words. Reversing a complete line may reset the printer due to the high current consumption when printing all black.
Reverse work with fonts 1, 2, and 4.

9. Introduced in firmware version 4.07

Notes • _____

_____

_____

_____

_____

_____

_____

_____

_____

_____

8

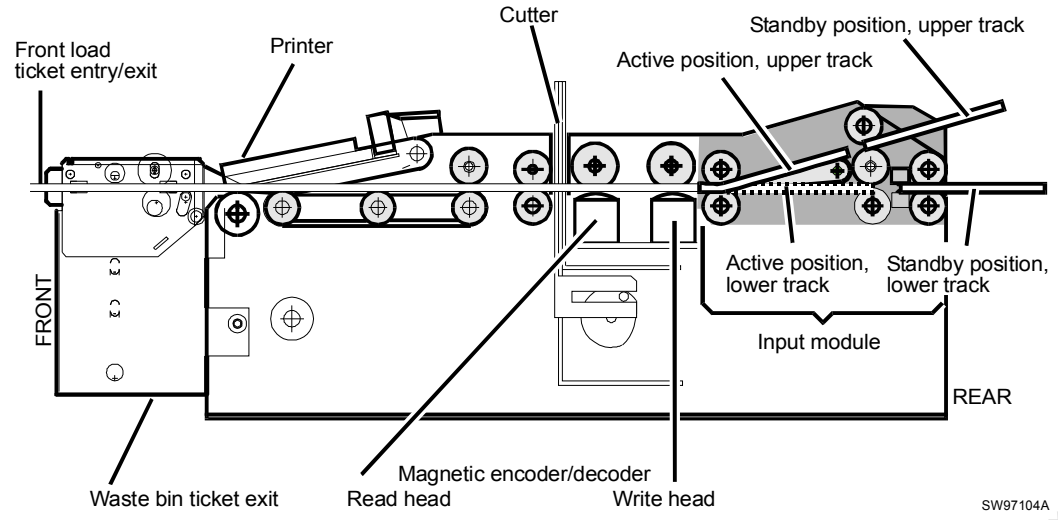
Single-Ticket Handling

Overview

The TTPM2 comes with one of two different single-ticket handling systems: upper rear entry load (standard), and front load (optional). In both cases, the upper document entry of the printer is used for the single-tickets.

This means that single-ticket processing restricts the use of fanfold ticket stock to the lower entry.

Figure 26 • Active and standby ticket position



Previously Encoded Tickets

One use of the single ticket handling is to process a ticket several times. For example, if you issue a return train ticket (Stockholm to Oslo and back to Stockholm) you can add print, and re-encode the magnetic stripe when the first part of the journey is made.

1. Use the applicable decode command to read the previously encoded ticket information.
2. The data is transmitted to the host computer, and the ticket is positioned in the active position of the upper entry, ready for a new encoding and printing.
3. Printing and encoding is effected using the same commands as for processing a ticket from a fan-fold ticket stock, and the ticket is ejected to the customer.

Note • To avoid printing on top of the existing print of a previously used ticket:

- Include information in the magnetically encoded string, about which area of the ticket has already been used for printing
- Read the magnetic stripe and let the host computer position new text on free spaces of the ticket.
- Update the magnetic stripe with correct information about used areas if the ticket should be used further.

Inserting a Single Ticket

In the standard TTPM2, inserting a single-ticket into the upper rear document entry, will trigger the single ticket loading process.

In front load printers, the application program must issue the command !L3 to trigger the single ticket loading. The yellow indicator on the printer will blink to indicate that the application program wants the operator to insert a single ticket. When a ticket is inserted, the loading process starts. To speed up ticket handling, the magnetic code of track two is read and placed in memory when loading the ticket from the front load option. !D will read track two data from memory without having to move the ticket.

The single ticket loading process will retract the fanfold ticket stock in the lower document entry to a standby position, and position the single ticket in the active position of the upper entry.

The subsequent command string automatically processes the operation on the single-ticket form.

Read and Decode

The following read (and decode) commands apply for the single ticket in active position:

!D	Read and decode track 2 (or center track). With front load option, track 2 (or center track) is read and the data stored in memory when the ticket is entered through the front entry. !D only reads the data from memory without moving the ticket.
!D1	Read and decode track 1
!D3	Read and decode track 3
!O	Read data from track 2 (or center track) and transmit data to host. No decoding.

The !D, !D1 and !D3 commands decode the information and scans for an end character (?). If found, the string is sent to the host computer in ASCII format. The start character is not included, but the stop character (?) and the checksum are transmitted. If no number is found, or if it does not comply with the ISO standard, a NAK+A is transmitted.

In either case, the ticket is automatically returned to active position, ready for encoding/printing or ejecting. After the read operation, the single ticket is again placed in active position waiting for either an eject-command for a command sequence for printing or encoding (or both) followed by !P for processing of that command string.

Encode and Print

Encode a new or modified string on the magnetic stripe. Use any of the magnetic encoding commands !I, !J, !K, !M, !N, !N+, or !O depending on what tracks are available in your printer, and what encoding you want. See *Introduction on page 7*.

Format the new print using the !F command.

Encode and print the ticket with the !P command.

The ticket will be ejected to the operator when correctly encoded and printed. In case of unsuccessful encoding, the single ticket is cancelled[10] and a new single-ticket form has to be inserted into the applicable document entry. A blinking yellow indicator prompts this.

10. The number of encoding retries, as well as the text to be printed on cancelled tickets, can be set with the !F M command. Cancelled tickets can be redirected to the optional front load waste bin by inserting an } or @ character in the string to be encoded on the stripe.

Ejecting the Ticket

If you want to eject the ticket without modifying the encoding or adding new print after reading the magnetic stripe, use an applicable eject command:

!E	Ejects the ticket through the upper rear document entry.
!L4	Ejects the ticket through the front entry.
!L5	Ejects the ticket to the waste bin of the TTPM2 Front Load 2.

9

Error Handling

The green indicator lights up at power ON. Should it fail to light up, switch the TTPM2 OFF and back ON again. If the green indicator is still OFF, check your power connection both in the TTPM2 and in the wall outlet. Also check your main power supply fuse.

Power Up [11]

When turning ON the printer it checks to see if a ticket is anywhere in the printer but the standard active position in the lower rear ticket entry. If it finds a ticket, the printer overwrites the magnetic encoding, prints VOID, and exits the ticket through the front ticket exit, and issues a NAK G to inform the host computer that a ticket has been voided. On printers with front load 2 option, the printer outputs the voided ticket into the waste bin. This is a security feature to ensure that no halfway ready tickets are outputted to the customer.

Normal Operation

Different error types can show up during processing. The most common is that the TTPM2 is out of paper. All errors encountered by the printer, and requiring operator assistance, are indicated with a signal from an indicator on top of the printer. The operator then has to follow a specific procedure depending on the type of error that caused the stop. The procedures are as follows:

Yellow indicator lights up	Indicates "No paper" in the selected paper entry. Insert new paper supply or new single ticket. The document will be automatically loaded to active position.
Yellow indicator ON and green indicator ON or flashing	No paper in the selected paper entry. Data string and print command have been received. Insert paper into the selected paper entry.

11. Only in firmware version 01660-xxx. Added to version 01660-330

Red indicator lights up	Indicates unsuccessful read-after-write. The TTPM2 makes a second attempt to encode and read the ticket. During that attempt the red indicator will go out. For each unsuccessful attempt, the red indicator lights up again. If a single-ticket operation is in progress, the red indicator stays ON until a new ticket is inserted and successfully processed. Also refer to the previously described procedures regarding the yellow and green indicators.
Red indicator is ON	If the Red indicator stays ON, even though ticket stock is present in the selected entry station, this indicates that the paper path in the TTPM2 has been blocked. Follow the description on the next page to remove blockage.

Note • No data is lost in the process of detecting and acting on errors as long as the printer is not switched OFF. If, however, the printer is switched OFF by mistake when an error is attended to, two tickets will normally be lost. Because of the error, the ticket being printed will be lost. The reason for the next ticket being lost is that even though the printer has battery backed up memory which preserves data, it is not possible to guarantee that no data is lost in the serial communication during the power OFF condition. It is, therefore, necessary for the printer to erase the input buffer and wait for either an !C or an !P command before it can synchronize printing to incoming data.

10

Error Codes and Status Reporting

The host computer uses the TTPM2 status reporting to determine if the print cycle has been completed or not. If not, error codes help determine what went wrong.

Status

When executing the print command !P, the printer confirms that the magnetic code is has been written and verified by sending an ”ACK” (06H) to the host. This indicates that the ticket in almost ready and should just pass the printhead and be outputted to the customer. You can extend the acknowledge procedure to send acknowledge for other things than magnetic encoding. See command !CA.

On firmware versions 01660-330 and later, an ”ETX” (03H) is issued when the print cycle is completed, which is when the ticket leaves the printhead. At this stage you can be reasonably certain that the ticket has been correctly issued, and you can proceed with the next ticket.

You can at any time[12] read the sensors in the printer with the “ENQ” (05H), and !S commands.

12. After a power off, the printer must first receive a !C or !P before answering status queries.

Security Additions

Additions intended to increase the security in the printer have been done between version 3.20 and 3.32 of the firmware. Status reporting is now used as a security measure to ensure that no manipulation has occurred that makes it possible to issue more tickets than intended.

When powering up the printer it looks for any unfinished ticket, voids it, and then issues an NAK G error code to inform about this.[13]

The printer issues an ETX (03H) to tell that the print cycle has been completed. [14]

A transaction string can now be appended to the ticket data using the !Q command. The string is stored in nonvolatile memory when the 03H is issued. This string can be read by the !V command, but there is no way to change the string other than issuing a new ticket.

During printing, a byte-counter is incremented and stored in battery nonvolatile memory. The counter starts at zero, and when the ticket is ready the counter has reached 5BE0h, which is 23520.

Dividing the byte counter value by the number of pixels on a line (384) gives the current pixel line. When the ticket is completed, we have printed bytes of pixel lines in the y-direction.

$$23520 / 384 = 61.25$$

61.25 x 8 = 490 pixel lines. You have 5.7 pixel lines/mm. mm which is one ticket length.

$$490 / 5.7 = 86$$

Should a power failure occur, before the counter reaches the full value (5BE0h) you can analyze the counter value to see if the ticket was as ready enough to pass as a usable ticket. In such case you should not issue a new ticket unless you get the NAK G that shows that the almost ready ticket has been voided.

A critical error status message informs the host computer if something happens in the printer that requires the operator to power it off.

13. Introduced in firmware 1660-xxx version 3.30 and for other firmware in version 4.11

14. Only in firmware version 01660-xxx.

Errors

TTPM2 reports error conditions in the form of error codes. An error condition is reported as a NAK (15H) followed by a one-character error code. The error codes have been defined, starting with ASCII character "1" (31H) according to the following table:

"1"	No paper in the entry path selected with !L1, !L2, !L17, or !L18.
"2"	Paper jam when executing !L1, !L2, !L17, or !L18.
"3"	Reserved.
"4"	Cutter error. No full cut performed. Cutter blade returned to home position by reversing the cutter motor.
"5"	Cutter error. Cutter blade not returned to home position.
"6"	Cutter error. Cutter blade not moving. If this error code is received immediately after power ON, it indicates that something is wrong with the +24V supply.
"7"	Paper jam when executing the !P command.
"8"	Magnetic encoding on track 2 (or center track) failed.
"9"	Magnetic encoding on track 1 or 3 failed.
"A"	Not possible to read magnetic information with !D, !D1, !D2, or !D3 commands.
”B”	No document inserted within time limit following an !L3 command (front load).
”C”	Document inserted (front load) but immediately retracted.
”D”	Document inserted through front load is blocked.
”E”	Document blocked in the front load input feeder during an !L3 command. Also used when combining the characters | and } in a hex magnetic string to get normal behavior if the encoding was successful. If an error occurs then the ticket is transported back to the start position and NAK + ‘E’ is sent.
“G”	Document found in the ticket path during power on has been erased, VOID-printed and ejected. [a]
P	If !P is sent to the printer and paper is out, it replies with NAK + P and discards data.[b]
"X"	Critical error. This is issued when the printer must be turned off, error condition cleared, then turned off again. [c]

a. Introduced in firmware 1660-xxx version 3.30 and for other firmware in version 4.11
b. Introduced in firmware version 4.13
c. Added to version xxxxx-330

Note • For TTPM2 to send ACK, or NAK + error codes, the DIP-switch 6 on the TTPM2 control board must be set to ON. Position OFF places the unit in a silent mode preventing these codes from being transmitted to the host computer.

Notes • _____

_____

_____

_____

_____

_____

_____

_____

_____

_____

11

Interface Description

The TTPM2 communicates through an RS232 serial interface.

DIP Switches

A DIP-switch is accessible through the service opening at the bottom of the TTPM2 enclosure. The functions of these DIP-switches are (default settings in parenthesis):

Switch	1	Bit/s	OFF	(9600)	ON	19200	ON	1200	OFF	115200
	2		OFF		ON		OFF		ON	

Switch	3	Read-after-write ON = Disable	OFF
	4	Auto clear ON = Clear all fixed and variable data during printing	OFF
	5	Handshaking ON = XON/XOFF, OFF = RTS/CTS	OFF
	6	ACK/NAK + error code ON = enabled, OFF = Silent	ON

Switch	7	Mode	OFF	Standard	ON	DCT	OFF	CD200	ON	Test
	8		OFF		OFF		ON		ON	

Important • DIP switches 7 and 8 are factory set and MUST NOT be changed. The switch settings must fit the hardware of the different models

Standard =	Consecutive lower entry + single-ticket upper entry
DCT =	Dual Consecutive entries
CD200 =	Card dispenser mode
Test =	Zebra production test setting, not to be used!

Note • Use RTS/CTS hardware handshake (dip-switch 5 = OFF) when ACK/NAK + error code is enabled (dip-switch 6 = ON).

Communications Protocol

The protocol is 8 data bits, 1 stop bit, and no parity. Handshaking is DIP-switch-selectable, either XON/XOFF or RTS/CTS (DIP-switch 5).

Communications Port

The following table shows how to connect the TTPM2 to the serial port of a PC compatible computer.

TTPM2 (9 pole D-sub)		PC (25 pole D-sub)	PC (9 pole D-sub)		
RXD	2	2	TXD	3	
TXD	3	3	RXD	2	
DTR	4	6	DSR	6	
GND	5	7	GND	5	
DSR	6	20	DTR	4	(not used)
RTS	7	5	CTS	8	
CTS	8	4	RTS	7	(not used)

Note • The leads marked "Not used" make it possible to turn the cable either way around.

Communications Cable

Caution • Using a non-approved cable with the printer may void the FCC and other EMC approvals of the printer.

Use a 9-pin serial cable to connect the TTPM2 printer to the host computer. Such a cable is available from Zebra. Part number 10825-000. The cable is 1.5 m long with 9-pole D-sub connectors at both ends (PC and TTPM2).

Adapters with 25-pole D-sub connector at the PC end of the cable are commercially available.

12

Document Stock

The TTPM2 printers are produced and calibrated for, and tested with the customers' ticket stock. To ensure accurate ticket issuing, we do require 100 tickets of the customer ticket stock for each ordered printer.

Ticket Base Material

Manufacturer	Type	Thickness µm	Sensitivity
Mitsubishi	TF 1767	183	High
Mitsubishi	TF 1775	181	Maximum
Mitsubishi	TF 1875	200	Maximum
Mitsubishi	TF 2467	255	High
Mitsubishi	TF 2475	255	Maximum
Ricoh	150UT-190µ	182	Very High
Ricoh	150UT-240µ	235	Very High

Type of paper or equivalent is recommended

Material	Paper, 100 % chemical pulp, no ground wood permitted
	Triplex[a] laminate[b]
	Plastic (PVC)

a. Triplex is manufactured from three paper stocks. The middle is usually recycled paper, and the top and bottom are different papers.
b. Laminate with plastic core may destroy the printhead and prematurely wear the cutter blades! DO NOT USE.
The perforation of the tickets may leave parts of the plastic core protruding through the surface of the ticket.
These plastic tongues may scratch the printhead, and also build up static electricity discharging through the printhead. This may seriously limit the printhead life.
If plastic laminate still is used, care must be taken in the manufacturing process to avoid the plastic protrusion, and the printer must be life-tested with the intended stock before taken into use.

Stiffness	18–36 g/cm (in grain direction)

Thickness	Paper and laminate: 0.18–0.40[a] mm, 170–210 g/m²	
	Plastic (PVC): 0.18–0.25 mm	
	Factory setting:	0.18–0.25 mm (default)
		0.26–0.32 mm (optional)
		0.33–0.40 mm (optional)
Curl	Deviation from flatness < 0.6 mm across the length, width, or diagonal of the ticket	

a. 0.18-0.32 mm for Frontload 1 and Frontload 2 versions of the printer

Coating and Preprint

Thermal coating	Shall meet or exceed the ANSI 3.11 specification	
	Smoothness:	Max. 75 Sheffield units
	Properties:	Same as fax grade 3
Top coating	The thermo-sensitive surface of the document stock can be provided with a protective UV or moisture proofing top coating	

Caution • Never use abrasive inks as they reduce the life of the thermal print head.

Preprint	Tickets can be preprinted on one, or both sides.	
	Ink for thermo-sensitive side:	Laser printer approved ink with-out whiteners
	Ink for magnetic stripe side:	Offset ink

Thermal-Print to Preprint Alignment

Tolerances in the printer, and in the ticket stock itself, can cause misalignment between the preprint of the ticket stock and the thermal print. The ticket guides in the printer are adjusted to 54.38 ± 0.05 mm. Narrower adjustment tolerances would cause paper jam when the relative humidity changes the ticket width.

A ticket width of 53.98 ± 0.2 mm gives a maximum misalignment of 0.65 mm (54.38 + 0.05 – (53.98 – 0.2)).

Note • Avoid designing tickets that require close alignment between preprint and thermal print.

Magnetic Media

Magnetic stripe	Side stripe positioned according to ISO 7811/2
	Center stripe (option)
Magnetic media	Full tape, transfer tape or slurry

Caution • In case of slurry, care must be taken to avoid excess slurry material and abrasive particles that may cause unduly high degree of wear on the magnetic recording and read heads in the TTPM2 .

Coercivity	Low: 300 Oersted
	High: 2750 Oersted (option)
	Other non-standard coercivities available on request

If a ticket is perforated, for stub separation for example, the perforation shall not infringe on the magnetic track to prevent interference with magnetically encoded data.

Ticket Dimensions and Perforation

Stock format	Gapped or non-gapped consecutive form tickets. Fanfold or roll[a].
	Sheet-cut (single) tickets for manual or dispenser loading.
Perforation cut direction	Perforation and cutting of ticket material must be done from the thermally sensitive side of the paper.
Document standard	ISO No. 7810
Ticket width	53.98 ± 0.20 mm
Ticket length	85.6 ± 0.25 mm, or 110.0 ± 0.25 mm
Corner radius	3.15 ± 0.3 mm (preferably without minus tolerance). Used for optical detection of top-of form.
Perforation for stub	Placed at the trailing end of the ticket
Gapped tickets	Two tabs according to Figure 27.
Non gapped tickets	Equal distance between tabs according to Figure 28.

a. Only suitable for on TTPM2 versions who where originally built for roll stock.

Figure 27 • Gapped tickets (for printers with cutter)

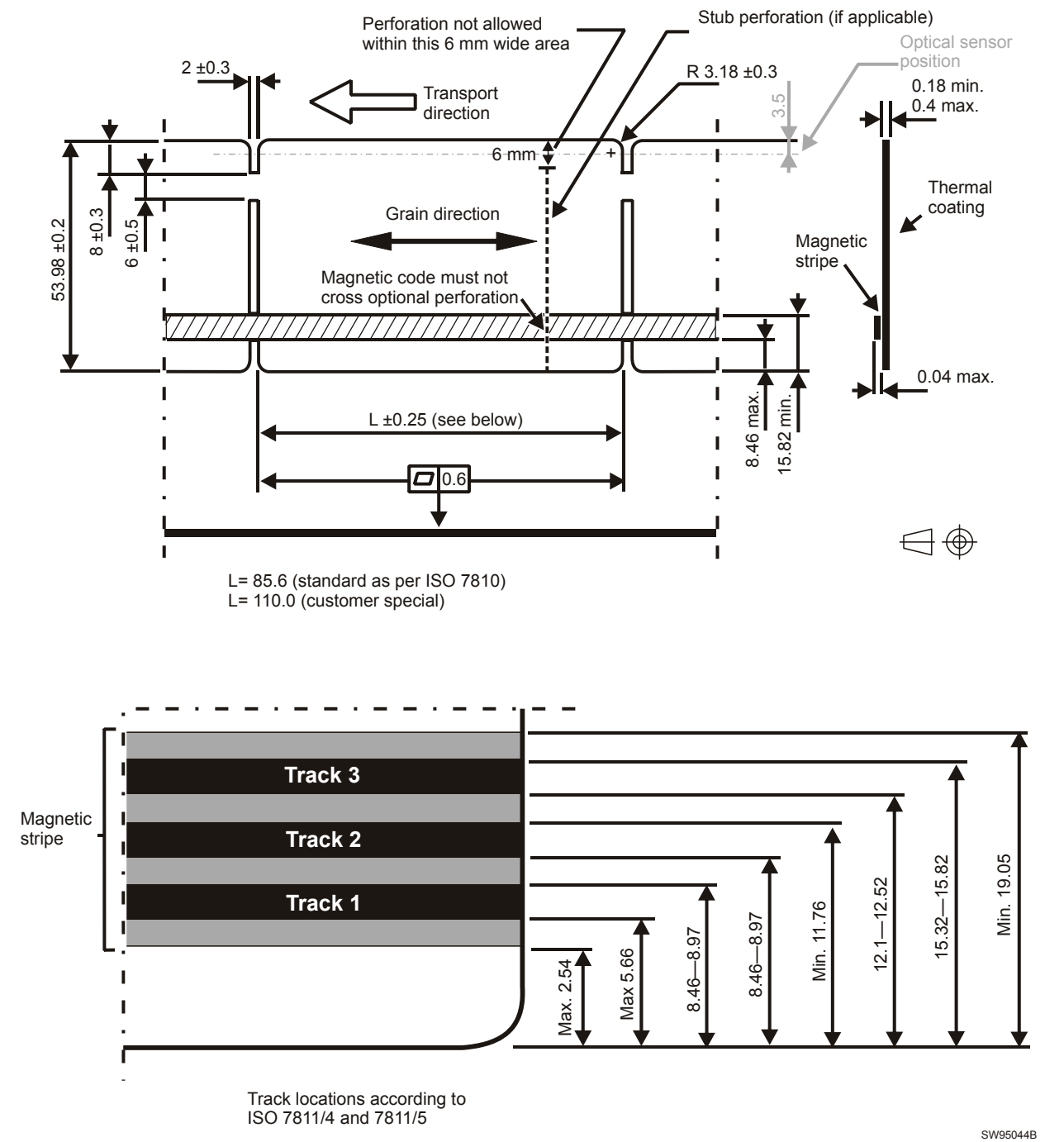


Figure 28 • Non gapped tickets (for printers with burst separator)

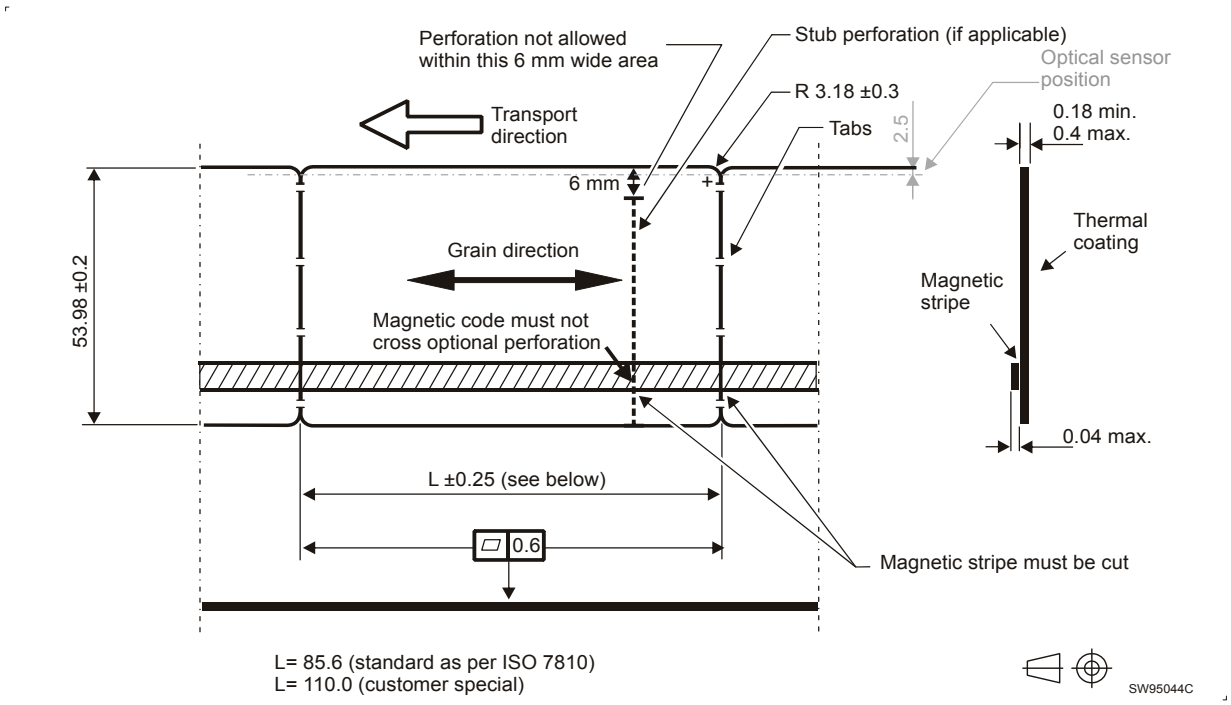
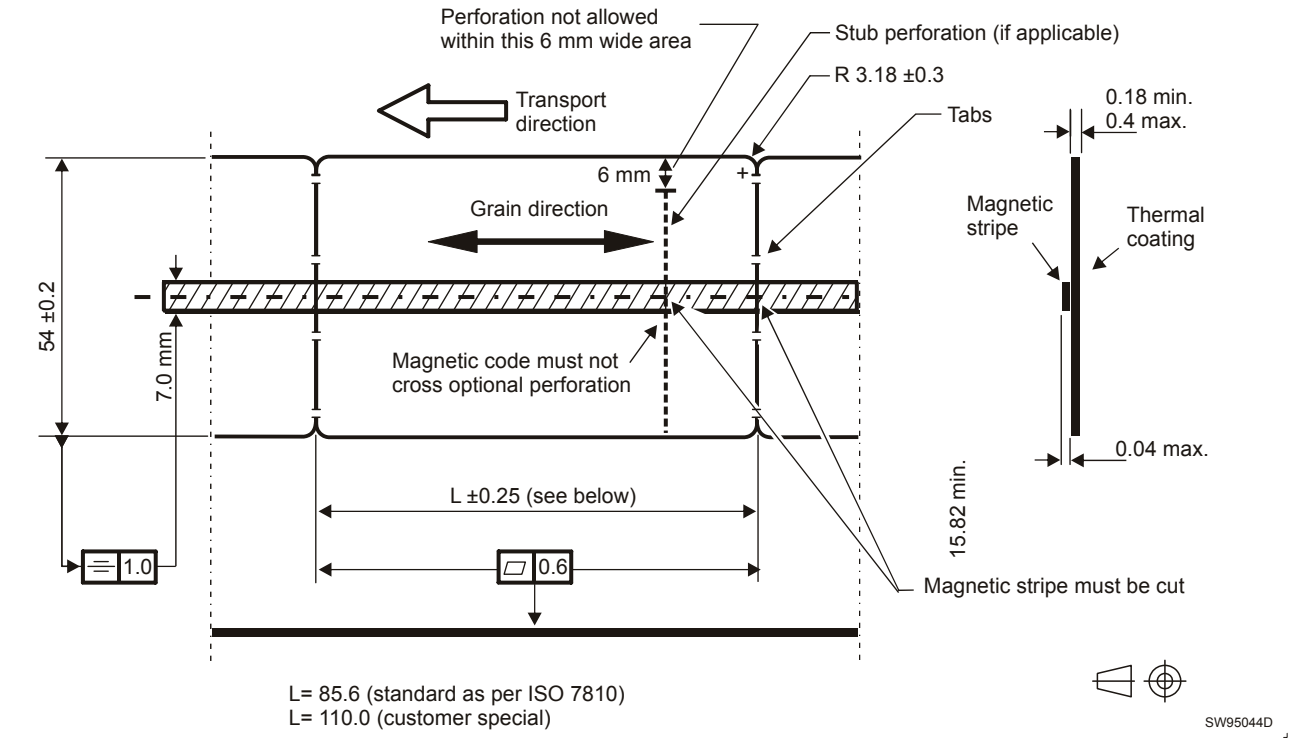


Figure 29 • Both gapped and non-gapped tickets with center track can be used in printers ordered with center track option



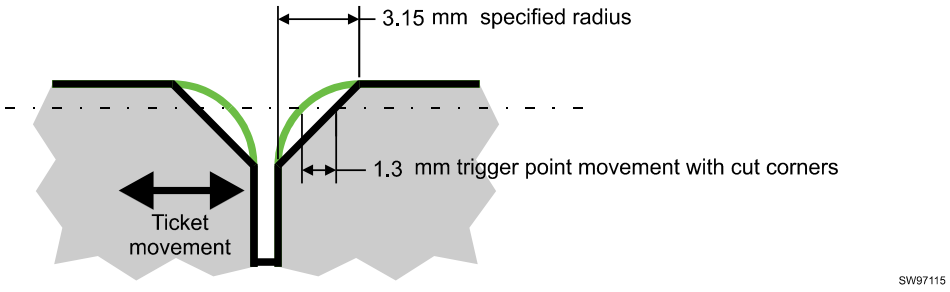
Tickets With 45° Cut Corners

Some applications are using tickets with cut corners without radius. These tickets are not within the specifications for use in the TTPM2 printer series. The effect will be that the ticket detection point moves about 1.3 mm, not only causing incorrect cut but also erroneous placement of the magnetic code.

The coding starts 1.3 mm too early resulting in synchronization zeroes being lost in the beginning of the ticket. On units configured for center track, the ticket should be readable in both directions. If synchronization is lost, the tickets will be readable if inserted one way, but not the other way around.

A solution to this problem is using HEX code for the magnetic message instead of ISO code. Thus you can compensate for the lost synchronization zeroes by adding additional synchronization zeroes in the beginning of the message. However, note that HEX encoded tickets are normally not readable in standard ISO-card readers.

Figure 30 • Ticket position is erroneously detected with 45° corners



Notes • _____

_____

_____

_____

_____

_____

_____

_____

_____

_____

13

Firmware History

Functions and features are being added from time to time affecting the firmware in the TTPM2. The following table lists the changes of general interest.

The TTPM2 firmware, residing in programmable read-only memory (PROM), is available in several customized versions. They differ only in minor details and are indicated by three letters. You will find these letters on the label attached to the PROM component. The standard version, for example, has the letters STD.

The standard version includes support for one consecutive ticket stock entry, one rear single-ticket entry, and the front load option. Please note that only some of the FW versions after release 2.13 have built-in support for either two consecutive ticket entries or one consecutive ticket plus one single-ticket entry.

Single entry printer PROMs are marked FW906-260, where 90**6** indicate single entry and 260 indicates revision 2.60.

Dual entry printer PROMs are marked FW907-234, where 90**7** indicate dual entries and 234 indicates revision 2.34.

From firmware version 2.70, all firmware is 906-xxx, and you select single entry, dual entries, or CD version with the dip-switches on the control board.

Notice that further FW revisions may have been introduced since the issue of this edition of the TTPM2 Installation and Programming Manual. An up-to-date list of FW revisions can be read at the Zebra web site at http://www.zebra.com.

FW Version	Change
3.20	Added commands !Q, !U, !V, and !N+. New magnetic encoding attributes added Only dual entry version: Does not accept ticket data **without** entry selection command. !L1, !L2, !L17, or !L18 must always be sent prior to every !P command. Signals NAK 1 to indicate error and discards the received data. **Restrictions** Same as 906-290
3.30	!F T modified with fixed spacing setting for font 1. New commands !Q, !U, !V and !N+ New error message NAK X Added power ON ticket detection routine that voids any ticket left in the printer at power OFF. An ”ETX” (03H) is issued when the print cycle is completed. **Restrictions** Same as 906-290
3.32	!W print progress indication command added, and improvements to the power failure cleanup.
3.50	Only barcodes of size 1 and 2 printed in east and west orientation will reduce print speed. **Restrictions** Same as 906-290
3.60	!Y “read ticket counter” command added **Restrictions** Same as 906-290
3.70	Characters added to positions 128 to 255 of fonts 1 and 4. Among them is the Euro symbol (€) in position 128. See Technical Specifications Manual for complete character set. **Restrictions** Same as 906-290
3.80	A ticket inserted in the rear upper slot before the TTPM2 has received a load command causes the red LED to start flashing and the TTPM2 waits for the ticket to be removed before continuing. To prevent a ticket that has been left sitting at the mouthpiece from being sucked in when a front load command (!L3) is received, the TTPM2 now senses if there is a ticket already in the mouthpiece when the !L3 is received and in that case it flashes the red LED until the ticket has been removed. **Restrictions** Same as 906-290

FW Version	Change
3.90	Fix added for the problem where the printhead were left in a raised position Default burn time has been reduced. A new command (!Z n) controls the burn time (blackness). **Note •** After installing this firmware you MUST do a three-button reset for it to set the burn time to the default value. Failing to do so will generate blank tickets Inserting a ticket at the rear upper slot after an !L3 command is prevented in CD- mode. New transmission speed introduced: 115200 baud. **Restrictions** Same as 906-290.
4.00	Upper solenoid activated during single ticket entry on Dual entry printers that are used as single entry one's. It is now possible to suspend operation after magnetic encoding by inserting a ~ character in the !M data string. A bug in the error handling of command !T has been corrected. Sensors in the upper and lower entry are used to verify that the ticket the upper rear entry is backed out enough when using lower entry DIP switch 3 now disables read-after-write on all three tracks (1&3 before) **Restrictions** Same as 906-290.
4.10	Reversed text added
4.20	Extended status (!CA) and power on clear. Bug correction. A timeout that caused problems on some printers has been removed. The problem was that the front motor sometimes did not start immediately causing a shift in print position. If !P is sent to the printer and the paper is out, it replies with NAK + P and discards data. The rear solenoid is released immediately if paper loading fails. New stepping sequence when reversing feed, but still the same speed as before. Startup cleaning function debugged.
4.35[a]	Internal speed increase test version, (more aggressive PIU timing) Implementing new cleaning routine that operates both motors if powered up with yellow button. Also allows setting of burn time using buttons. Speed improved when building the ticket image.

FW Version	Change
4.40[1]	Problem found which could cause trailing ticket to be fed to long after cutter. Fixed. !O n implemented. n=1 results in 512 bits read from track 1. . n=3 results in 512 bits read from track 3. Any other value including none gives the standard !O reply. Possibility to change start & end frequency on encoding motor (command !F A … … 1), and on the printing motor (command !F A … … 2),and new default parameters for speed. Code 128 and EAN 128 added.
4.55	PIO Timing changed back
4.61	The possibility to reset after a critical error has been removed because it caused problems when printing many small bitmaps.
4.64	When reading track 3, the string was only terminated with an LF. This is now corrected to CR/LF as it is on the other tracks.
4.70	Stepper motor for encoding now runs half-steps instead of full steps. This gives a smoother ride and improves encoding reliability

a. Some control boards using NEC PIO dated 0213 LDW02 may not start with versions 4.22 to 4.54

Index

Notes •

Numerics

03H, 77, 92

A

ACK/NAK, 27, 40, 77, 79

B

Bar-code, 26, 47
Battery, 29
BMP-files, 46
Bold text, 68
BPI, 51
Buttons, 17
Byte-counter, 78

C

Canceling a ticket, 49
Card dispenser, 16, 20
Carriage Return, 24
Center track, 88
Center track tickets, 88
Character set, 52
Checksum, 52
Clear all, 33
Coating and preprint, 85
Code 39, 48
Coercivity, 86
COM port, 10
Command acknowledgment, 27
Command Reference, 33
Command set, 23
Command syntax, 24
Commands
  Document entry related, 31, 40
  Magnetic encoding/decoding, 32, 51
  Print related, 43
  Summary, 30
  System related, 30, 33
Communications cable, 82
Communications port, 82
Communications protocol, 82
Converting graphics, 46
Corner radius Se
Critical error, 79
Cutter error, 79

D

Data bits, 82
Decoding, 53
Default
  Restore values, 17
DIP switches, 81
Document
  Dimensions, 86
  Examples, 61
  Front entry, 19
  Rear entry, 19
  Stock, 84
Document-entry commands, 31, 40

E

EAN13, 48
Eject document
  Into waste bin, 41
  Through upper rear document entry, 40
  Via front document entry, 41
Encoding attributes, 53
Entry tray, 15
Error codes, 79
Error handling, 75
ETX, 77, 92

F

Fanfold ticket paper entry tray, 15
Firmware history, 91
Firmware version query, 35
Font, 44
Format
  Bar-code, 47
  Graphics printing, 30, 38, 45
  Print field type, size, position, orientation, 43
  Print on canceled ticket, 49
  Text printing, 43
Front load, 72
Full tape, 85

G

Gapped tickets, 87
Graphics, 25
  Converting to TTPM2 format, 46
  Data, 45
Ground, 10

H

HEX coding, 51
Hico, 86
Hopper Se Card dispenser

I

Indicators, 17

Initialize
Command, 29, 59
Installation, 9
Interface description, 81
Inversed text See Reversed text
ISO 7811 coding, 51

L

Laminate, 84
liability, 2
Line Feed, 24
Load document from front entry, 41
Loco, 86
Lower document entry, 19

M

Magnetic codes, 26
Magnetic encoding
Attributes, 53
Commands, 32, 51
Failiure, 79
Retries, 54
Magnetic media, 85
Magnetic stripe, 85
Orientation, 19
Memory, 29
Clear, 29
Moisture proofing coating, 85

N

NAK 1, 79
NAK 2, 79
NAK 4, 79
NAK 5, 79
NAK 6, 79
NAK 7, 79
NAK 8, 79
NAK 9, 79
NAK A, 79
NAK B, 79
NAK C, 79
NAK D, 79
NAK E, 79
NAK G, 75, 79
NAK X, 79
No document inserted, 79
No paper, 79
Non gapped tickets, 88
Nonvolatile RAM, 29, 78

O

Orientation, 43
Output tray, 14

P

Paper, 84
Loading, 18
Out indication, 18
Paper jam, 21, 79
Parity, 82
Perforation, 86
Plastic, 84
Positioning data, 26
Power failure, 59
Power supply
Connector, 13
Power up, 59, 75
Preprint, 85
Print, 33, 37
Commands, 43
Speed, 47
Printer mechanism, 12
Printing
Bar-codes, 47
Capability, 25
Graphics, 38, 45
Text, 43
Printout
Triggering, 27
Progress indicator, 30, 35, 36, 78
Pushbuttons, 17

R

RAM, 29
Read transaction string, 35
Read-after-write
Cancel, 53
Reading and decoding, 53
Reset, 17
Reversed text, 69
RTS/CTS, 82

S

Select document entry
Lower rear, 40
Lower rear, and signal paper out, 42
Upper rear, 40
Upper rear, and signal paper out, 42
Serial interface connector, 11
Sheet-cut tickets, 20

Single-ticket handling, 71
Slurry, 85
Start-up, 59, 75
Start-up synchronization, 59
Status request, 35
  Immediate, 36, 38
Stock format, 86
Stop bit, 82
Summary of commands, 30
Syncronization zeros, 51
Syntax, 24
System commands, 30, 33

T

Text, 43
Text attributes, 68
Ticket
  Cancellation, 49
Ticket base material, 84
Ticket dimensions, 86
Tickets with 45° cut corners, 89
Top coating, 85
Track 1, 51
Track 2, 51
Track 3, 51
Transaction string
  Read, 35
  Write, 34
Transfer tape, 85
TTPM editor, 46

U

Upper document entry, 19
UV coating, 85

V

Variable, 44, 64

W

Windows bitmap, 46
Write transaction string, 34

X

XON/XOFF, 82

Zebra Technologies International, LLC
333 Corporate Woods Parkway
Vernon Hills, Illinois 60061.3109 U.S.A
T: +1 847 793 2600
Toll-free +1 800 423 0422
F: +1 847 913 8766

Zebra Technologies Europe Limited
Dukes Meadow
Millboard Road
Bourne End
Buckinghamshire, SL8 5XF, UK
T: +44 (0)1628 556000
F: +44 (0)1628 556001

Zebra Technologies Asia Pacific, LLC
120 Robinson Road
#06-01 Parakou Building
Singapore 068913
T: +65 6858 0722
F: +65 6885 0838

http://www.zebra.com

© 2009 ZIH Corp.

P1003645-001